Proceedings

1978 Illinois Vegetable Growers Schools with grower suggestions

University of Illinois at Urbana-Champaign
Agricultural Experiment Station
Cooperative Extension Service, College of Agriculture

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FOREWORD

This Proceedings is our first effort to provide a publication for use at our commercial vegetable grower meetings. It is the result of the cooperation of many research and extension personnel from the College of Agriculture.

The Proceedings records information presented at 1978 Illinois vegetable schools, reports research from the University of Illinois, and provides extension recommendations for vegetable growers. The presentations of speakers at the statewide vegetable growers meeting held in Champaign have been included to make this information available to growers not able to attend. Updates on pest problems, along with current recommendations for insect, disease, and weed control, make this booklet a valuable reference manual for year-round use by all market growers throughout Illinois.

We express our appreciation to commercial seed companies, agricultural chemical manufacturers and suppliers, the Illinois Vegetable Growers Association, and commercial growers for their support of our programs.

Additional copies of this Proceedings are available at a cost of $2.00 each. Make checks to the University of Illinois and send to the Department of Horticulture, 124 Mumford Hall, Urbana, IL 61801.

W L George

W. L. George, Head
Department of Horticulture

This publication was compiled and edited
by J. W. Courter, Professor of Horticulture

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THE VEGETABLE INDUSTRIES - CHALLENGES AND OPPORTUNITIES

J. F. Kelly

Because of Florida's important position as a vegetable producer, I believe it is appropriate to address those problems and opportunities which we are experiencing and generally assuming that these problems are almost universal in the U. S. vegetable industry. Therefore, I have chosen to present a "state of the industry" report prepared in 1974 and updated in 1977.

The vegetable industry, with an economic output multiplier of 2.04, is second only to new construction in its relative contribution to Florida's economy. Thus, the $524 million of vegetables produced in 1975-76 generated an additional $1.25 billion within Florida's economy.

Let's just look at a few of the general challenges we anticipate in the next ten years.

One key to maintaining our well-fed citizenry and to maintaining a healthy industry is a continuing supply of well-trained and highly-motivated managers, teachers, extension agents, technical representatives and salesmen. Given an adequate supply of these specialists, we can look forward to better farm laborers, more responsive middlemen and better informed consumers.

The demand for technically-trained specialists in areas related to vegetable crops has been high. We anticipate that this demand will increase as we move into the eighties, as it becomes more evident that management skill is the best collateral that can be offered to secure a loan. Our supply industries must furnish more than fertilizers, pesticides and materials if they are to compete effectively. They must furnish good service. The banker who lends money for a vegetable operation must know more than just finance, he must have access to technical knowledge about the deal he is financing (crop costs up to $5,000/a). The extension worker in an urban county can no longer be "all things to all people." He may have to serve large commercial growers and thousands of home gardeners and as such must be a specialist.

In the commercial production, harvesting and marketing of vegetables, the most difficult task for the decade ahead is to try through sound management to meet the squeeze put on by increasing production costs -- costs which have not been accompanied by corresponding increases in farm prices.

J. F. Kelly is Chairman, Vegetable Crops Department, University of Florida.

Management is important to all growers, even the small operator who may be marketing his labor and that of his family. Its importance is best illustrated by some recent crop cost and return figures.

Table 1. Cucumbers (1968-1972 - S. W. Florida)

Yield/a	199 bu	403 bu	185 bu
Growing cost/bu	$2.14	$1.06	$2.30
Harvesting and marketing cost/bu	$2.28	$2.28	$2.28
Net profit/bu	$ .15	$1.23	$-.01

For cucumbers in Southwest Florida, the mean costs for growing ($2.14/bu) and harvesting and marketing ($2.28/bu) produced an average net return of 15¢/bu based on an average yield of 199 bu/a. But yields of 403 bu/a were reported. Using the same cost figures, it is clear that production management (and good growing conditions) which can increase the mean yield to 403 bu/a would increase the profit to $1.23/bu due to the reduced growing cost per bu. On the other hand, a small lapse in management (or a bad turn in the weather) resulting in a reduction of just 14 bu/a would turn a profitable crop into a loser.

This example, for which we might have used almost any vegetable crop, indicates the importance of production research and variety development--for it is through this work that we will be able to increase crop yields or to prevent yield decreases which might be brought about by fertilizer shortages, water use restriction, diseases, insects, weeds and other barriers to top production efficiency.

Not reflected in the available cost figures used in the previous example is the phenomenal increase in material costs experienced since 1972. In most cases, these costs are relatively fixed, but there are opportunities to partially compensate for some of the increases through various conservation programs in fertilization, fuel use and integrated pest control. The responsibility for instituting these programs lies with individual growers.

Going with these programs must be programs to preserve the environment, particularly as our vegetable production areas become closely associated with urban centers.

It is not difficult to see how production efficiency can have a marked effect on resource conservation. A 25% increase in average yields translates into the same total production on 80,000 fewer acres, with corresponding savings in water, fuel, fertilizer and other materials. It has been demonstrated in northeast Florida that the water saved on the 7,000 acres of vegetables now equipped with underground water transfer systems saves enough water annually to supply the needs of over 50,000 households. The vegetable industry must consider benefits such as these in every operation they undertake.

Although increased yields probably give us the largest single potential for high returns, there are numerous other opportunities to reduce costs -- a nickel here, a penny there -- both in crop production and in harvesting and handling.

There is a wide variation in the efficiency of growers in harvesting and packing. For example, one Florida pepper grower is able to pick and pack his crop for 54¢/bu compared to a typical industry-wide range of 70¢ to $1.20. If his low cost represents a 35¢/bu efficiency, that's over $2,000,000 which might be saved each year on this Florida crop.

Increased efficiency does not necessarily require full mechanization. It may involve a highly mechanized system such as that employed with bush beans; it may involve employment of harvesting aids; it may involve a rearrangement of existing equipment; and in many cases, it may simply involve more efficient use of labor.

Agricultural labor costs vary considerably depending on the crop but for vegetables they average about a third of the total cost of growing, packing and selling. During the current inflationary period, other costs have increased faster than labor. The average pay scale for agricultural labor is far below that in other industries, yet by and large, it does not require less skill (often more) than common labor jobs in other industries. And the hard work of agricultural labor does not make it attractive.

Research into the social, cultural and economic aspects of farm labor and studies of labor-management systems is vitally needed. Education of growers in modern labor-management methods and education of laborers so that they can better exercise their skills must be stressed. It is important that we promote a better understanding of the common problems of growers and laborers.

The negative image often given to agriculture might be reversed if agricultural labor and management were to act together to impress upon the consuming public that food is still a good buy in America (some fresh vegetables are selling at pre-World War II prices today), and that if they want food and they want those who produce it to get a fair return for their investment or their labor, they must pay for it.

Mechanization has done much to increase the efficiency of handling but in many cases has increased damage to vegetables. In some cases, it has reduced the labor requirement but generally it has not reduced the packinghouse labor requirement. Important exceptions are for carrots and radishes -- two crops which would not have become so important in Florida if the harvest and packaging operations were not mechanical. Mechanical harvest has become standard for a few crops which previously relied on hand labor -- the bush bean harvester replaces about 70 hand pickers. Hand harvesting of beans was tedious work and could not attract the necessary regular supply of laborers. Without mechanical harvest, this $25,500,000 crop would nearly have been eliminated.

Most crops will continue to be handled largely by human labor. For some of our crops, mechanical harvest is not feasible or advisable -- e.g., staked tomatoes and strawberries. For others, only some degree of mechanization is needed as a means of reducing the drudgery and relocating the labor within the harvesting-handling operation.

Also to be considered is the newly available labor brought about by the closeness of many of our vegetable operations to urban population centers. We must be prepared in the next ten years to respond to the possible effects of a more stable labor pool, higher wages, better working and living conditions, unionization and other unknown factors.

There is an urgent need to preserve land for its best long-range use. Many of the "warm" lands which have been important for the production of tender crops have been irrevocably lost to urban development. Over-looked in the past has been the value of retaining vegetable acreage in close proximity to urban centers. It provides "breathing room," recreational opportunities (e.g., U-pick and community gardening) and employment opportunities for people of all ages and results in problems of mutual concern -- tax rates, water usage, noise pollution, pesticide use restrictions, labor housing requirements, schools and still others as yet not evident. These problems must be identified and solved for the mutual benefit of the farmer and the urban dweller.

The market structure for vegetables is complex, disorganized and in many ways inefficient. There is clearly a need for increased inputs in this area -- to identify specific problems through research and to educate the industry through extension. However, the industry is already aware of many of the inefficiencies which ultimately lead to higher consumer prices. We are already beginning to see changes in some of the traditional marketing and related handling practices and if the industry is to prosper in the next decade, we must see more rapid progress.

Palletization is rapidly becoming essential for sales to chain store buyers. It is important from the standpoint of produce quality, cost reduction, transportation efficiency and simply to fit into the industry-wide system used for other grocery items.

Standardization of containers must accompany palletization. It has been estimated that as few as four standard container sizes might be used for all Florida produce which is now shipped in well over 100 different containers. This alone would result in significant economies and would simplify marketing and transportation.

More important than a standardized package will be a <u>standardized high-quality pack</u>, so that there is uniform understanding of what a given package contains.

We are likely to see more consumer packaging and increased trimming at the shipping point. Transfer of such operations from the receiving end to the shipping end will benefit the economy fo the producing area, will reduce the problem of disposal in urban centers and will reduce the amount of non-salable produce which must be shipped.

Vegetables can play a major role in improving the income of small farmers, particularly with the increasing demand for farm-fresh produce. There is a need to develop efficient systems for production and marketing of "off-season" and low-volume vegetables. These crops present particularly difficult challenges in the area of pest control.

The great interest in vegetable gardening brought about by rising living costs is likely to remain high. We believe it is a healthy development, and we should maintain a good level of support for this largely urban-oriented activity. Likewise, there is a need to continue the special place held by vegetable crops in youth programs.

Ultimately, the key to growth of the vegetable industry is the ability of growers, shippers, handlers and final distributors to deliver the consumer nutritious, tasteful, safe and economically-priced vegetables.

Quality is maintained only if every link in a 7-10 day chain from producer to consumer is not broken.

Rather than merely stressing consumer <u>acceptability</u>, it is important that we emphasize consumer <u>preference</u>.

It is evident from our vegetable report that there are great opportunities for continued growth of the vegetable industry. It is likewise evident that numerous obstacles stand in the way of this growth. Some internally controllable conditions can largely determine the extent of growth. These factors and the attention given to them can serve as a source of optimistic projections. We know most of these internal factors can be modified through a balanced program of applied and fundamental research, extension and sound crop management.

There are also numerous external factors (e.g., weather, new pest problems, the general economy, resumption of ties with Cuba and others) which can have profound effects on the industry. We can expect to continue improvement of many internal factors, but also to be unable to improve on others due to lack of resources. A few of the external factors will have a positive effect, and probably more will have negative effects. But, we cannot accurately predict the exact combination of these responses.

Table 2. <u>Production Potential for Florida's Leading Vegetables - 1980-85</u>

Crop	Total Production (% of 1972-73) Low	High	Actual (1975-76)
Tomatoes	61	95	126
Sweet Corn	80	112	103
Celery	105	126	82
Potatoes	72	100	114
Peppers	76	107	112
Watermelons	70	97	126
Cabbage	88	129	107
Beans	67	95	108
Escarole and Lettuce	109	143	82 (141)
Cucumbers	22	125	123
Squash	81	119	119
Strawberries	85	159	111
Eggplant	86	97	147
Total value ($ millions) All vegetables	308	430	93% in real dollars

Thus, for some crops, we may expect modest increases in production. For others, probably few, we can expect levels approaching the indicated low estimates. Overall, we look forward to crop values approaching the sum of the high estimates, with values for individual crops lying within the range. The impact of lack of positive grower reaction might be expressed best by the contrasting total crop value potentials corresponding to the low and high projections. Hopefully, we have underestimated the potential for growth of most of the crops.

FLORIDA SWEET CORN - PAST, PRESENT AND FUTURE

J. F. Kelly

Prior to the development of DDT in the 1940's, Florida was considered an unlikely place for the culture of sweet corn. Control of insects, especially the corn earworm was economically prohibitive. Since 1950, when it became obvious that the sweet corn industry was there to stay, the levels of production have increased at an average annual rate of nearly 6%. In the 1975-76 season, Florida growers shipped nearly ten million crates -- 86% of the total U.S. supply for the period November 1-June 26 -- with an F.O.B. value of nearly $50 million.

Most of Florida's sweet corn crop is on plantings of 500 or more acres -- fewer than 40 growers raise 95% of the crop. The late fall, winter, and early spring crop is produced on about 15,000 acres in the southeast sandy and rockland soils. The fall, late winter and spring crop is produced primarily on the much soils south of Lake Okeechobee. A second large organic area in north-central Florida produces about a third of the spring crop.

Pressures of urbanization and the ever-increasing costs of production (not accompanied by corresponding increasing prices) are threatening the winter production on the "warm" coastal lands. The cost factors likewise threaten the fall and spring crops, but increased efficiency and high yields have sustained this portion of the industry. The level of efficiency has even made it feasible for certain processors to investigate contracting for raw product for frozen corn on the cob.

Florida corn has developed a reputation for being worm-free -- an easy task in the early days. Without DDT it is necessary to spray with less effective chemicals -- in some cases on a daily basis for three weeks, mostly by airplane (nearly $100/a.).

The once-over harvest operation is by hand (with or without harvesting aids) or with two-row harvesters (either FMC or Boots). The hand harvest cuts down on the selection process at the packing house but does not eliminate sorting. The machine-harvested corn requires much sorting. The FMC machine reduces the trimming but can give some kernel damage if the machine is not properly adjusted and operated. The Boots machine (locally custom manufactured) does little damage but leaves long shanks which must be trimmed.

Wirebound crates are used almost exclusively, the size varying with location, season and variety. Usually 50-60 ears are packed per crate. Since this is one vegetable sold on a per piece or per dozen basis, buyers are very particular about the count. Because of the extreme perishability of sweet corn, the crop is hydrocooled on palletized stacks. Most corn moves to market in refrigerated trucks

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with top-icing.

Despite all the precautions taken to maintain quality, a large portion of the crop is improperly handled at one or more locations in the distribution chain. For that reason, we have undertaken to introduce new high-sugar varieties which at harvest contain 2-3 times the normal sugar levels and which maintain high levels even if exposed to room temperature for several hours or even days. The newest introduction, 'Florida Staysweet' is also highly resistant to Northern leaf blight. This three-way cross is being marketed through Illinois Foundation Seeds, Inc.

Typical cost and return values for Everglades corn, based on 14 growers with an average of about 1350 acres each and an average yield of 200 crates per acre, include a growing cost of about $250 per acre, a harvesting and marketing cost of about $350 per acre and a net return of only about $25 per acre.

Why then, does anyone grow sweet corn? It fits nicely into the sugar cane cycle. It fits into the mixed-load marketing requirements. And, of course, there's always that optimistic, "Maybe next year."

Corn: Florida and United States Total Recorded Movement, in Crates
November 1 - June 26 Latest Ten Crop Years

Crop Year	Florida	United States	Percent Total Recorded Movement from Florida
	---1,000 crates---		---Percent---
1966-67	8,486	9,284	91
1967-68	7,599	8,666	87
1968-69	8,439	9,673	87
1969-70	7,478	9,088	82
1970-71	8,349	9,488	87
1971-72	8,461	10,270	84
1972-73	9,570	11,048	87
1973-74	8,877	9,953	89
1974-75	8,913	10,150	88
1975-76	9,697	11,241	86

Sweet Corn: Acreage Planted by Areas, By Seasonal Quarters,
Crop Years 1975-76 and 1976-77

Area	1975-76				1976-77			
	Fall	Winter	Spring	Total	Fall	Winter	Spring	Total
	Acres				Acres			
West			1/				1/	
North			900	900			700	700
N. Central	400		11,100	11,500	900		10,800	11,700
W. Central			2/				2/	
E. Central								
Southwest	3/	3/			3/	3/		
Everglades	12,300	2,200	19,400	33,900	12,200	2,800	18,300	33,300
Southeast	1,500	9,400	3,200	14,100	1,300	9,700	6,600	17,600
State	14,200	11,600	34,600	60,400	14,400	12,500	36,400	63,300

1/ West Included with North. 2/ West Central included with North Central.
3/ Southwest included with Southeast.

AN ILLINOIS SWEET CORN GROWER'S OUTLOOK

Bill Keller

The future of southern Illinois sweet corn growers is clouded at this time. There is little doubt that the next few years promise to be very rough.

Two diseases new to the area have appeared within the last two years. First came wheat streak in 1976. Our University specialists quickly recognized and diagnosed the problem, but plant breeders have not become overly excited because we are a small area and severe damage has been spotty. The same disease was back in stronger force the next year. Several chemical control test plots gave no conclusive results.

In addition, dwarf mosaic Race A appeared in 1977. From the widespread reports of maize dwarf mosaic from the northern half of the nation, it was apparent that the breeders were caught with their "genes" down. One seed company put in a "crash program" variety test plot in southwestern Illinois in early July. Unfortunately, every variety was susceptible. If one wishes to look for the silver lining in this problem, it is the widespread scope of the infestations that dictates an all-out effort by plant breeders to get on the ball to save their industry and ours.

At the present time we are told there is no chemical solution to either disease, so this puts the ball in the plant breeders' laps. We hear reports that it will take five years to develop new tolerant varieties. This cannot be accepted in southwestern Illinois. I am not saying everyone will quit; but if we must wait five years, most of the present growers will no longer be in business! Some, no doubt, will persist. Because of our proximity to the St. Louis market, it is unthinkable for us to give it to someone who does not enjoy the freight advantage we have. Experience has shown that once a grower switches from vegetables to grain he seldom returns to that profession. We <u>must</u> have an accelerated effort by the seed producers to "come up" with an acceptable variety by the 1979 planting season. If we have another bad year in 1978, I can see no reason to continue beyond that unless the seed companies give us some encouraging evidence that they are making "good" progress. I believe that we can help alleviate the wheat streak problem with chemicals. Since it is spread by the wheat curl mite, University of Illinois entomologists should be able to help us learn how to monitor and control the insect; thus, partially solving the problem.

A public relations program, sponsored or assisted by the University of Illinois Extension Service, would help educate the homemaker and store manager that this problem is temporary and tolerable. Before we had irrigation, this type of product was accepted "as normal" during drought conditions. A few kernels missing on the butt end did not matter. Now the public has been accustomed to and expects "picture-perfect" corn; and, without a change, we are not going to have it next year.

Bill Keller is a commercial vegetable grower, Collinsville, Illinois.

Southern Illinois growers are not quitters, but I do not believe that they will stick around five years waiting for University of Illinois researchers or commercial seed producers to develop a competitive variety. No, we need a better effort than that to brighten the future for southern Illinois sweet corn growers.

Editors note: Illinois ranks 3rd in sweet corn for processing and 10th in sweet corn grown for the fresh market. Illinois farmers grew 59,300 acres of sweet corn in 1976. Of this total approximately 5000 acres were sold to the fresh market with a value of 1.8 million dollars.

SWEET CORN VARIETIES - TODAY AND TOMMORROW

A. M. Rhodes

Americans eat about 11 billion ears of fresh or home processed sweet corn a year. This averages out to one ear per person each week. Have you had your quota this week?

To a plant breeder sweet corn might be defined as corn with "defective" genes, called mutations, whose actions result in the accumulation of sugars in the place of starch in the endosperm of the kernel. In contrast, endosperms of field corn and popcorn are high in starch and low in sugar content. A great amount of research is in progress to increase the sugar content and sweetness of sweet corn.

There are different kinds of genes and gene combinations that control the accumulation of sugars in sweet corn. These genes may be grouped as standard sweet, extra-sweet, modified sweet, and synergistic sweet. The names of these genes and their characteristics, discussed below, are summarized in Table 1.

Standard sweet. Most of the vegetable corn grown today is called sweet corn or sugar corn. The kernels contain moderate levels of sugar due to the effects of the sugary gene, which is symbolized by geneticists as su. The su gene also causes the accumulation of water soluble polysaccharides (WSP), which impart a creamy texture to prepared sweet corn products. No other corn gene, known today, produces high levels of WSP. Loss of sugars is the major post-harvest problem with standard sweet corn. Most of the varieties currently listed in seed catalogs are standard sweet (su) unless otherwise noted. Popular examples of su varieties are Gold Cup and Silver Queen.

Extra-sweet. Relatively new extra-sweet corns that retain their high levels of sugar after harvest are becoming more and more popular. The high sugar levels found in the kernels are due to the effects of a gene called shrunken2 (sh2). The name is descriptive of the appearance of the dry mature kernels. Seeds of extra-sweet varieties do not usually germinate as well as seeds of standard sweet varieties. Popular varieties currently listed in seed catalogs are called "X-tra" sweet and examples are Illini X-tra Sweet and Early X-tra Sweet.

At least 3 other genes are known that also produce high sugar levels. These genes are referred to as brittle (bt), brittle2 (bt2), and shrunken (sh), respectively. It is likely that at least one of the brittle genes will be bred into corns adapted to temperate climates. In Hawaii, bt, bt2, and sh2 corns are already being used as tropical vegetable corns. When these new corns become available as commercial varieties in the continental states, it will be important that growers "know their corn genes", because cross-pollination among these types will result in starchy kernels. Likewise, cross-pollinations of extra-sweet with standard sweet (su) produce starchy kernels.

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Gene combinations. High sugar levels similar to that found in kernels of extra-sweet corn can also be obtained through the combined action of other genes known as amylose extender (ae), dull (du) and waxy (wx). Considerable research has been devoted to the chemistry of these 3 genes to help breeders understand the "sweetness" of the corn kernel. If this type of "extra-sweet" corn is introduced, the growers' choice will be greater, but his life will be more complicated, because cross-pollination with other types produces starchy kernels. The dry, mature seeds of ae du wx corns are generally not as shriveled as the brittles and shrunkens, and whether they will germinate better is still a question. To date, the only ae du wx corn is experimental.

Modified sugary. At the University of Illinois we have recently discovered a modified version of sugary corn, which we call su-IL677a. This "gene" produces endosperm sugars almost as high as the brittle and shrunken corns, along with the high WSP content of standard su. This corn may find future use because its kernels remain edible 4 to 5 days longer than standard sweet corn (su). If one parent is su and the other parent is su-IL677a, then the resulting hybrid contains 75 percent su kernels and 25 percent su-IL677a kernels. Dry, mature kernels of su-IL677a are slightly more shriveled than standard su, and may affect seed germination. To date, no varieties have been introduced where both parents carry this trait.

Synergistic sweet. A type of sweet corn has been introduced recently that incorporates both the sugary gene (su) and a shrunken gene (sh2). To produce this corn, both parents must carry the su gene and the pollen parent must also have the sh2 gene. The kernels of the resulting hybrid all contain the su gene, but 25 percent of these kernels also have the sh2 gene. The taste sensation of such hybrids is sweeter than standard sweet corn with little detectable difference in texture. The hybrid seeds resemble standard sweet (su) seeds, and they germinate as normal su hybrids. The term synergistic has been suggested for this corn. Currently two varieties are available: Sugar Loaf and Honey Comb.

Future research. It might be concluded that to get "extra sweet" corn, we must sacrifice good germination. However, research is in progress to produce sweeter corns that will also germinate well. One complicated process involves the incorporation of an alien gene from a grass relative of corn. Do not expect this corn to appear in seed catalogs in the near future; it is only mentioned to give you an idea of what research workers are doing to help the corn industry.

Sweet corn research is conducted by at least 14 state and federal experiment stations as a cooperative program. In addition, the experiment stations cooperate with seed companies in field trials and meet once each year at the "Sweet Corn Breeders Roundtable" to report new findings, discuss ideas, and exchange materials. The list of varieties on page 13 are fresh market corns suggested by various seed companies for trial in Illinois.

TABLE 1. PARTIAL LIST OF MUTANT ENDOSPERM GENES OF CORN AND THEIR USE IN HYBRIDS

Name	Cross[1]	Hybrids Sugar	Hybrids WSP[2]
Standard sweet (i.e., Gold Cup)	su x su	moderate	high
Extra sweet (i.e., Illini X-tra sweet)	sh2 x sh2	high+	low
"Synergistic" sweet (i.e., Honeycomb)	su x su sh2	high-	high-
--------	su-IL677a x su-IL677a	high	high
--------	ae du wx x ae du wx	high+	low

[1]Cross-pollination of sh2, su, and ae du wx produces starchy corn
Cross-pollination of su, su-IL677A, and su sh2 produces "normal" sugary su corn
[2]WSP = water soluble polysaccharides

LIST OF SWEET CORN CULTIVARS OF POSSIBLE MERIT FOR ILLINOIS FRESH MARKET GROWERS

A. M. Rhodes and B. J. Jacobsen

This list of cultivars with maturity and market suitability was compiled by survey of seed company breeders and plant pathologists. All of the companies listed breed sweet corn but not all sell seed directly to growers. All of the cultivars in this list have not been thoroughly tested in Illinois.

Disease tolerance is denoted by the letter T. Tolerance does not imply immunity (freedom from disease) but indicates that the cultivar will perform well under pressure from a given disease. Some varieties marked tolerant to maize dwarf mosaic virus (MDMV) and wheat streak mosaic virus (WSMV) are listed on basis of preliminary testing. Producers should be aware that a given cultivar may react differently to combined MDMV and WSMV infections or may be susceptible to one or more of the various strains of MDMV. Growers are encouraged to grow new varieties in test plots and to evaluate them for their farm and market.

			Market		Disease tolerance if known[2]					
Cultivar[1]	Company	Maturity days	local	ship	MDMV[3]	WSMV	Bact. wilt	NCLB	Smut	Rust[4]
Spring Gold	H	66	√		T					
Seneca Star	RS	66	√	√	T		T		T	
Early Sunglow	CH	67	√							
Aztec	A	68	√	√	T	T	T		T	
Earliking	NK	69	√							
Sundance	H	69	√	√	T	T				
Earlibelle	H	71	√	√	T		T			T
Carmelet	S	72	√	√						
Comanche	A	72	√	√			T		T	
Beacon	R	73	√	√						
Intrepid	CR	74	√	√						
Northern Belle	H	74	√	√			T			

(continued)

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LIST OF SWEET CORN CULTIVARS OF POSSIBLE MERIT
FOR ILLINOIS FRESH MARKET GROWERS

Cultivar[1]	Company	Maturity days	Market: local	Market: ship	Disease tolerance if known[2]: MDMV[3]	WSMV	Bact. wilt	NCLB	Smut	Rust[4]
Platium Lady	CR	74	√	√						
Early Xtra Sweet (sh2)	I	75	√							
Xtra Sweet 77 (sh2)	I	75	√	√						
Starlet	S	75	√	√			T			
Sugar Daddy	FM	76	√							
Candy Bar(sh2)	FM	76	√	√						
Reliance	NK	76	√					T		
Wintergreen	A	77		√	T	T	T	T	T	
Bellringer	H	77	√	√	T		T		T	
Cherokee	A	79	√	√	T		T	T	T	T
XP 370	A	79		√	T		T	T	T	
Quick Silver (white)	H	79	√	√	T		T			T
Gold Winner	H	79	√	√			T			
Apache	A	80		√			T	T	T	
Comet (white)	A	80	√	√		T	T	T	T	
Gold Cup	H	80	√	√			T		T	T
Merit	A	80	√		T		T		T	
Lancer	S	80	√	√			T			
Honeycomb (swxsu sh2)	NK	80	√	√				T		T
Capitan	A	82	√	√	T		T		T	
Bonanza	FM	82	√	√		T	T			
XP 2500	A	82	√	√			T		T	
Target A	FM	82	√							
Jubilee	R	82	√	√						T
Gardner(2428)	R	82	√	√						
Gold Lady	S	82	√							

(continued)

LIST OF SWEET CORN CULTIVARS OF POSSIBLE MERIT
FOR ILLINOIS FRESH MARKET GROWERS

Cultivar[1]	Company	Maturity days	Market: local	Market: ship	Disease tolerance if known[2]: MDMV[3]	WSMV	Bact. Wilt	NCLB	Smut	Rust[4]
Sugar Loaf (su x sush2)	NK	83	√	√				T		
NK 199	NK	83	√					T		T
Hallmark	NK	83	√		T		T			
Seneca Raider	RS	83	√	√			T		T	
Epic	N	84	√					T	T	
Gold Crown	H	84	√	√			T			
Resister	N	85			T				T	
73-3044	R	85	√	√			T			
Stylepak	FM	85	√				T	T		T
Illini Xtra Sweet(su2)	I	85	√							
Seneca Chief	RS	85	√			T	T			
Commander	A	86	√						T	
Enterprise	CR	86		√						
Hyb. Sweet Tennessee	K	86	√		T					
Hyb. Sunshine State	K	86	√		T					
Sweet Sal (bicolor)	H	86	√	√			T			
Florida Stay Sweet(sh2)	I	87	√	√				T		
Golden Queen	R	88	√	√		T	T			
Bi-Queen (bicolor)	R	88	√	√		T	T	T		
Silver Queen (white)	R	88	√	√		T	T	T		

(continued)

LIST OF SWEET CORN CULTIVARS OF POSSIBLE MERIT
FOR ILLINOIS FRESH MARKET GROWERS

			Market		Disease tolerance if known[2]					
Cultivar[1]	Company	Maturity days	local	ship	MDMV[3]	WSMV	Bact. wilt	NCLB	Smut	Rus
Golden Sweet EH	CH	88	√							
Kandy Korn EH	CH	89	√	√						
White Lighting	CR	89	√	√				T		
Golden Gleam (W9625)	H	90	√	√	T		T	T	T	T
Iosweet EH	CH	91	√	√						
Tendersweet	CH	95	√	√						

[1]All are standard sugary cultivars unless indicated (sh2 or su x sush2). See page 10 for discussion. For sources and seed companies see page 51.
[2]MDMV = maize dwarf mosaic virus, WSMV = wheat streak mosaic virus, bact. wilt = Stewart's bacterial wilt, NCLB = northern corn leaf blight.
[3]Tolerant to some strains
[4]Tolerant in University of Illinois research and demonstration plots

SWEET CORN DISEASES; BIOLOGY OF PATHOGENS AND AN INTEGRATED CONTROL PROGRAM

B. J. Jacobsen

Sweet corn is affected by many of the same diseases which affect common field corn. Since the primary economic value of sweet corn occurs relatively shortly after silking, many late season and harvest diseases of field corn are not important in sweet corn production. The only exception to this would be sweet corn seed production. Losses due to plant diseases in sweet corn can be reduced through the use of a well planned integrated disease control program.

An integrated disease control program utilizes: crop rotation, resistant varieties, fungicides, insect vector control, balanced soil fertility, clean plow down of crop residues, timely planting, and other good horticultural practices. The choice of one or more of these individual control practices is based on the biology of the pathogen and on the relative risk of disease losses.

The biology of the most important sweet corn diseases is discussed below. Of particular importance is how the pathogen survives and spreads, and what conditions favor disease development, and the relative risk of disease loss.

Disease: Seed rots and seedling blights.
Pathogen: *Pythium* spp., *Rhizoctonia solani*, *Fusarium moniliformae*, *Penicillium oxalicum*, and *Colletotrichum graminicola*.

Symptoms: Poor stands and yellow, weak seedlings which often wilt and die. Seed may rot before emergence or seedlings will show a soft rot of lower stem (mesocotyl) and root tissues. Leaf tips may become grey then brown gradually affecting whole leaves prior to death of seedlings.
Survival and spread: The fungi involved in seed rot and seedling blight diseases inhabit most soils or, are associated with infected seed or corn crop residue.
Favored by: Planting damaged seed in cold, wet, soils. Deep planting, poor seed vigor, herbicide injury, or other factors which slow emergence and seedling growth can also be important.
Control: Sow mature, high-quality, crack-and disease-free seed treated with a good fungicide seed protectant such as captan, thiram, Vitavax, Vitavax-Thiram or zineb. Plant seed in a well prepared seed bed when soil temperatures at the 2-inch level are about 50 F.

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Risk factor: So long as the above controls are utilized, stand losses will be within acceptable limits. Stand losses may vary from 0 to almost 100 percent if controls are not used. Hybrids with the sh2 gene may have more problems with seed rot and seedling blight under stress conditions.

Disease: Stewart's bacterial wilt and leaf spot
Pathogen: *Erwinia stewartii*

Symptoms: Infected plants wilt rapidly, resembling plants suffering from drought, nutritional deficiency, insect injury, or seedling blight. The leaves show pale green to yellow stripes with irregular or wavy margins which parallel the veins and may extend the length of the leaf. Infected leaves usually die quickly. Plants which are severely infected develop chocolate-brown cavities in the lower stalk pith. These cavities can be readily seen when the lower stalk is split lengthwise. After tasseling, short to long irregular pale green to yellow streaks may appear in the leaves. These streaks eventually die and become straw colored and can usually be traced back to flea beetle feeding scratches.
Survival and spread: The Stewart's wilt bacterium survives the winter within the body of the corn flea beetle or in infected corn. Corn flea beetles are the primary means of spread during the growing season. Spread by infected seed and other insect vectors is not important in the USA.
Favored by: Stewart's disease is favored by mild winters and other factors which favor the winter survival of corn flea beetles. High temperatures and high ammonium nitrogen and phosphorous levels relative to potassium levels also favor disease development.
Control: This disease is best controlled by planting disease-resistant or tolerant hybrids (see page 13). Insecticides to kill corn flea beetles can be used for control where susceptible hybrids are grown. (Follow recommendations of entomologists).
Risk factor: Stewart's disease can cause losses of 50-100% on susceptible hybrids. The risk of disease losses for susceptible hybrids can be predicted based on the sum of the average temperature in December, January and February (Table 1). This forecasting system actually predicts the winter survival of the corn flea beetle.

(See Table 1 on page 23)

Disease: Holcus leafspot and bacterial leaf blight.
Pathogen: Pseudomonas syringae (Holcus) and Pseudomonas alboprecipitans (bacterial leaf blight)

Symptoms: Holcus leaf spot: Typical symptoms are creamy white to tan, translucent leaf spots which appear oil-soaked. These leaf spots are bordered by a narrow reddish-brown margin and are most common on lower leaves. Bacterial leaf blight: this disease will appear as small, elliptical leaf spots or narrow stripes on lower leaves. Lesions are at first olive-green and oily and later become tan and dry. *Note*: These diseases may be confused with Paraquat injury. Both diseases will appear shortly after heavy rainstorms.
Survival and spread: These bacteria survive on corn, sorghum, sudangrass and other grass residues and are spread by splashing rain.
Favored by: These bacterial diseases are favored by warm (70-95 F), rainy, windy weather.
Control: Rotate with a nongrass crop (forage legume, soybean, vegetables, etc.) and maintain a high level of potassium in the soil.
Risk factor: Although these are amongst the most common sweet corn diseases they rarely cause any yield loss.

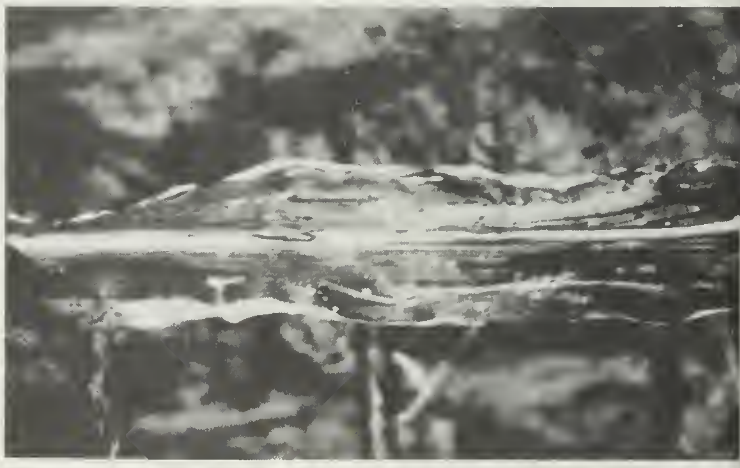
Disease: Helminthosporium leaf blights and spots. (Southern corn leaf blight (SCLB), Northern corn leaf blight (NCLB), Helminthosporium leaf spot.
Pathogen: Helminthosporium maydis (SCLB), Helminthosporium turcicum (NCLB), Helminthosporium carbonum (Helminthosporium leaf spot).

Symptoms: SCLB: (leaf on right) Tan spots (1/4 - 1/2 x 3/4 inch) with brown to yellow-green to purple borders. Only leaves are infected by race 0 of this fungus. Sheaths, stalks, husks, and ear parts can be infected on hybrids with T or P male-sterile cytoplasms.

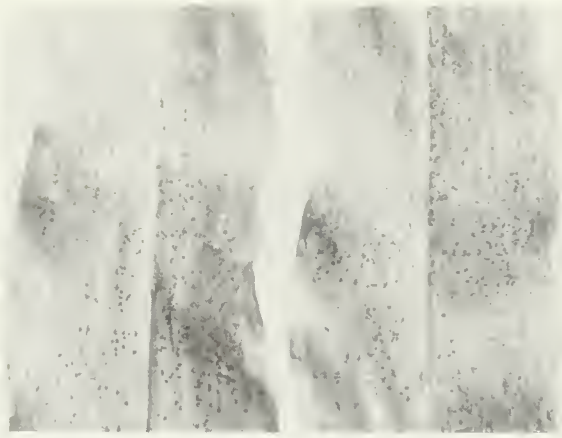
NCLB: (2 leaves on left) Large (1 1/2 x 6 inch) elliptical, grey-green to tan leaf spots which appear first on lower leaves.
Helminthosporium leaf spot: Tan (1/4 inch x 1/4 - 1 inch) round to oval leaf spots with brown margins. Leaf spots may show concentric zones. Leaf sheaths, husks, and ears may be infected.
Survival and spread: These fungi survive as spores and mycelium in corn and grass residues. Spread is mainly by wind-blown and water-borne spores.
Favored by: Warm (60-85 F), moist weather and heavy dews favor these fungal disease
Control: Plant resistant hybrids (see page 13). Fungicide applications beginning at the first sign of disease and repeated at 7-10 day intervals will provide good control. Bravo, mancozeb (Dithane M45 or Manzate 200) or Polyram can be used; however, Bravo may only be used on fresh market corn.

Crop rotations with nongrass crops, maintainance of high balanced fertility, and clean plow downs will also aid in control. If crop rotations are not used, fields should be scouted for these diseases. If one of the Helminthosporium leaf blights is present, crop rotation should be strongly considered.
Risk factors: These diseases will be most severe in fields where an infected corn crop occurred the year before. Losses can range from 0-50 percent. The earlier the plant is infected, the greater the potential yield loss. Unless the lower 30 percent of the plant is infected within 1 week of silking, fungicide applications are not economically justified. Late season plantings are generally most severely affected.

Disease: Anthracnose
Pathogen: Colletotrichum graminicola



Symptoms: The leaf blight phase of this disease is characterized by round to oval (1/2 inch diameter), yellow, leaf spots. Leaf spots have light brown centers and reddish borders. Under severe infections, entire leaves yellow and die. Several days later these leaves will be speckled with black fungal growth (spines (setae)) of the anthracnose acervuli when observed under 10X magnification. Leaves, husks and stalks can be infected. Stalk rot appears as a brown wet rot of lower stalk tissues.
Survival and spread: This fungus survives on corn crop residues and is spread by air and water-borne spores. Infection of seed is known, however, this is not thought to be important in Illinois.
Favored by: This disease is favored by warm (60-90 F), wet weather and tillage practices which leave undecomposed corn residues on the soil surface.
Control: Clean plow down of crop debris and rotation will give good control. Fung cidal controls have not been worked out.
Risk factors: This disease can cause up to 100% yield loss. However, yield losses will be unimportant where crop rotation and clean tillage are used.



Disease: Common Rust
Pathogen: *Puccinia sorghi*

Symptoms: Rust will appear as small, oval to elongate, golden or cinnamon-brown-black, dusty pustules on leaves. Severely infected leaves will yellow and die prematurely. Small tan leaf spots may occur on hybrids having certain types of resistance.
Survival and spread: This fungus survives on corn in the southern USA and is spread northward by spores carried by southerly winds.
Favored by: Warm (60-75 F), moist weather and heavy dews are favorable for disease development.
Control: Plant tolerant or resistant hybrids (see page 13). Zineb, maneb, mancozeb, or Bravo sprays will also control this disease.
Risk factor: This disease may cause losses up to 20 percent. Generally, only later plantings are affected seriously enough to justify fungicide applications. This disease is most damaging in northern Illinois.

Disease: Common Smut
Pathogen: *Ustilago maydis*

Symptoms: Small to large white galls filled with black dust (spores) may be found on all plant parts. Seedling infections may result in seedling death. Plants with galls on lower stalks may be barren or produce several small unmarketable ears.
Survival and spread: The corn smut fungus survives in the soil and is spread by anything which moves infested soil.
Favored by: Hot, dry, windy weather, high nitrogen levels, heavy manure application, and injury from blowing soil, hail, cultivation equipment or other factors favor smut infection.
Control: Plant tolerant hybrids (see page 13). Avoid injury to plants. Maintain well-balanced soil fertility.
Risk factor: Yield losses of up to 15 percent have been recorded. Planting tolerant hybrids and using good horticultural practice should keep losses to less than 5 percent.

Disease: Maize Dwarf Mosaic Virus (MDMV)
Pathogen: Virus

Symptoms: Symptoms first appear on youngest leaves as an irregular, light and dark green mosaic (mottling). As symptoms develop, narrow yellow streaks will appear along green veins. Stunting, excessive tillering, multiple ear shoots and poor seed set can also occur.
Survival and spread: The A strain of MDMV overwinters primarily in Johnsongrass while the other strains overwinter in numerous perennial grasses. The A strain may also infect several perennial grasses. This virus is spread (vectored) by at least 12 species of aphids including the corn leaf aphid, the greenbug, and the green peach aphid.
Favored by: Warm, dry weather.
Control: Grow tolerant hybrids (see page 13). Hybrids may be tolerant to only one or several strains of MDMV. There is no immunity. Destroy Johnsongrass or other perennial weed grasses near corn before planting.
Risk factors: Disease losses from 0-50 percent have been observed. Planting adjacent to overwintering hosts significantly increases risk as does late planting. Yield losses are greatest where the plant is infected early. Serious quality losses can occur in the form of poor seed set.

Disease: Wheat Streak Mosaic Virus (WSMV)
Pathogen: Virus

Symptoms: Plants are often stunted and yellowed. Small yellowish spots and streaks develop at the tips of young leaves. These streaks will elongate and parallel the veins. Older leaves may become chlorotic and even show scorching of leaf tips and edges. Ears are generally poorly developed with poor set set.
Survival and spread: WSMV overwinters primarily in infected wheat. Volunteer wheat is important in establishing infection in fall planted wheat. WSMV can also overwinter in several perennial grasses. This virus is spread by the wind-blown wheat curl mite.

Favored by: Warm, dry weather.
Control: Plant tolerant hybrids (see page 13). Plant as far away from infected wheat fields as possible. Destroy volunteer wheat at least 1 week before planting winter wheat. Plant winter wheat as long after the fly-free date as possible.
Risk factor: WSMV can cause losses up to 30 percent and can seriously reduce market quality. Early infections are most severe. Coinfections with MDMV can cause greater yield losses than either virus alone.

Several other diseases such as crazy top, southern rust, maize chlorotic dwarf mosaic virus, Pythium stalk rot, Bacterial stalk rot, Eyespot, Yellow leaf blight, and nematodes can cause losses in certain fields. Information on these diseases can be found in the book "A Compendium of Corn Diseases" published by The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121. The cost is $7.00 per copy. This book is available from either the above address or the Department of Plant Pathology, 218 Mumford Hall, University of Illinois, Urbana, IL 61801.

Table 1. Stewart's disease severity forecast based on the sum of the average temperatures during December, January and February

Temperature	Predicted Disease Severity Wilt	Leaf blight
less than 80 F	absent	absent
80-85 F	absent-light	absent-light
85-90 F	light-moderate	light
90-95 F	moderate-severe	moderate
greater than 95 F	severe	severe

This disease is usually only a serious threat in the southern one-half of Illinois because of the winter temperature - flea beetle survival relationship.

TIME PATTERNS FOR SWEET CORN DEVELOPMENT

Charles Y. Arnold

"The fleeting moment of perfect flavor" is a phrase used to emphasize the fact that sweet corn passes rapidly through an acceptable range of quality. It, therefore, becomes the grower's problem to make sure that the "fleeting moment" is there at the time he is ready to harvest and the consumer is ready to buy. It is a tricky part of the sweet corn business, in a large part, because the development of the plant is tricky.

To understand the overall problem one must first understand the sequence of developmental stages that the sweet corn plant goes through to reach the "fleeting moment". The story starts in the seed.

When you plant the seed you already have a head start. Four leaves are present in the embryo. Under the microscope, they appear as 4 inverted cones over a round growing point. After planting the seed, the round growing point initiates one leaf after another until, responding to a genetic or environmental signal, the growing point elongates and initiates a tassel. The initiation of the tassel usually occurs in a midseason cultivar about 21 days after planting, when 7 leaves are visible, and the growing point is still underground. Also, at this stage of development the total number of leaves on the main stalk is fixed.

Further development of the main stalk involves the elongation of internodes which are the spaces between the points of leaf attachment. This results in pushing the developing tassel above ground, through the whorl of enveloping leaves, and finally we have an erect stalk surmounted by a tassel. When the tassel matures it produces male flowers which shed pollen. This is essential to the production of a good crop of sweet corn, but not to the timing of the "fleeting moment" at harvest time. We have been considering the development of the main stalk.

The secret of timing is in the side shoots where the ears develop. Depending on the genetic potential of the cultivar and environmental influences, one or more of the lower side shoots may develop into suckers. They may be small or as high as the main stalk. Another group of 5 to 6 side shoots at the top of the plant do not develop at all. In the middle of the plant there is a group of 5 to 6 side shoots that develop ears. Each follows the same sequence. A round growing point initiates one leaf and stem section after another. The leaves become the husks and the stem becomes the shank. Then the round growing point elongates, just like the growing point on the main stalk, but produces an ear instead of a tassel. Under a microscope one can see the elongation and the appearance of bumps. These appear first at the base of the elongating axis, finally catch up, and the whole axis is covered with bumps. Each bump is a cluster of 4 female flowers, two upper and two lower ones. The lower ones usually abort leaving two at each position along the

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axis. This accounts for the fact that each ear has an even number of rows unless, of course, the lower ones do not abort. Then you have 4 kernels developing in a space provided for 2, and you wind up with the type of cultivar we call, in general, a Country Gentleman sweet corn. In their development the kernels push each other to the extent that no even rows are distinguishable. The things we have said about the development of sweet corn rows are interesting, but have no significant bearing on the time to harvest.

The sequence of ear initiation is important. One would think that the lowest side shoot in this middle group, that are potentially ear producers, would produce an ear first. Not so! The lowest side shoot of the middle group starts development first. It looks the biggest under the microscope, but, it is the last to initiate an ear. The first ear is initiated on the top side shoot of this middle group. It not only initiates an ear first, it depresses the development of the ear shoots below it. If its depressive effect is not too great, the ear below may also reach a marketable size. But, regardless of how many reach marketable size, the sweet corn plant will produce 5 to 6 ears. If you don't believe this, carefully strip the leaves off a plant at harvest time. The lower ears may be only an inch long, but they will be there, bumps and all. When we talk about the time to harvest, we are talking about the stage of maturation of the first (top) ear.

Now we go back to the development of the individual kernel to establish another important point. Each female flower on the developing ear produces an elongated structure which we call a silk. The silk is pushed through the enveloping husks into the open air. This is important from the standpoint of timing because it is the first time the female flower has been available for a visitation from the male flowers of the tassel in the form of pollen. The light, dry pollen is carried by air currents to the silk. One estimate is that there are 50,000 pollen grains for each silk. After a pollen grain lights on a silk it germinates, produces a pollen tube that grows downward through the silk. The male gametes unite with the female gametes and a new sweet corn kernel is born. The shedding of pollen from the male flowers in the tassel is important in the production of a marketable ear, but is not important in the timing of harvest. Pollen is shed over a period of several days. It may begin 2 or 3 days before the silks appear. But, it is only when the silks appear and are available for a pollen visitation, that the final phase of kernel development can be triggered.

Both physical and biochemical changes are involved. After the triggering action of pollination, the ear elongates and reaches its maximum length about halfway between silking and harvest. The enlargement of the cob and the kernels result in an increase in the diameter of the ear. The combined effects of these two aspects of development is an increase in yield that continues right through the time of harvest. These developmental events are related to yield. The biochemical changes within the kernel dictate the time of harvest which occurs long before the potential yield is achieved. This presents an interesting contrast between the harvesting of sweet corn and field corn. The potential yield of field corn, on a dry weight basis, is reached weeks or months before harvest. The field corn has to dry down to the point that it will not incur significant injury in the harvesting operation. After this point, the time of the harvest is dictated by financial or environmental considerations. This is not so with sweet corn. The consumer is interested in sweetness and tenderness.

Sugars, which contribute to sweetness, move into the developing kernels from other parts of the plant. But, in the sweet corn cultivars we have been used to, the sugars are rapidly converted into water soluble polysaccharides, and then to starch. The sweetness reaches a peak and then goes down. This situation may change in the near future. We have been used to sweet corns based on the sugary gene. New sweet corns are available which are based on the shrunken 2 or brittle 2 genes. In these types of sweet corn, the sugars move into the kernels, but their conversion to water soluble polysacchrides and starch is delayed. If these types that develop more sugar and retain it over a longer time become accepted, then the idea of the "fleeting moment" of perfect sweetness may not be as important.

But the consumer is also interested in tenderness. As the kernel matures, it gets progressively tougher. This is associated primarily with changes in what we call the hull or skin of the kernel. A scientist would call it a pericarp, because the kernel is a fruit and the skin or hull (pericarp) is the wall of the fruit.

The time pattern for a typical midseason cultivar is shown in Figure 1. It is

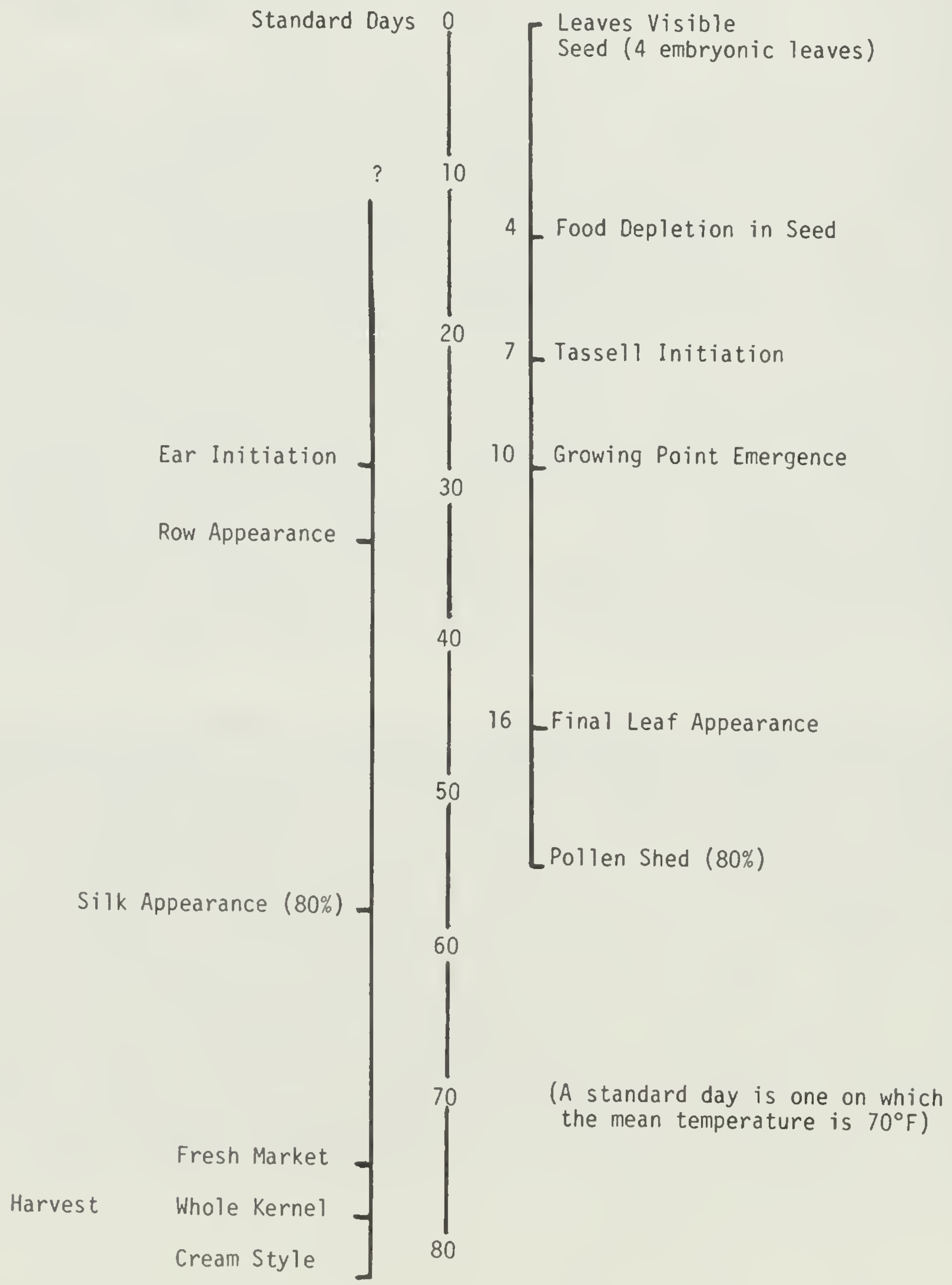
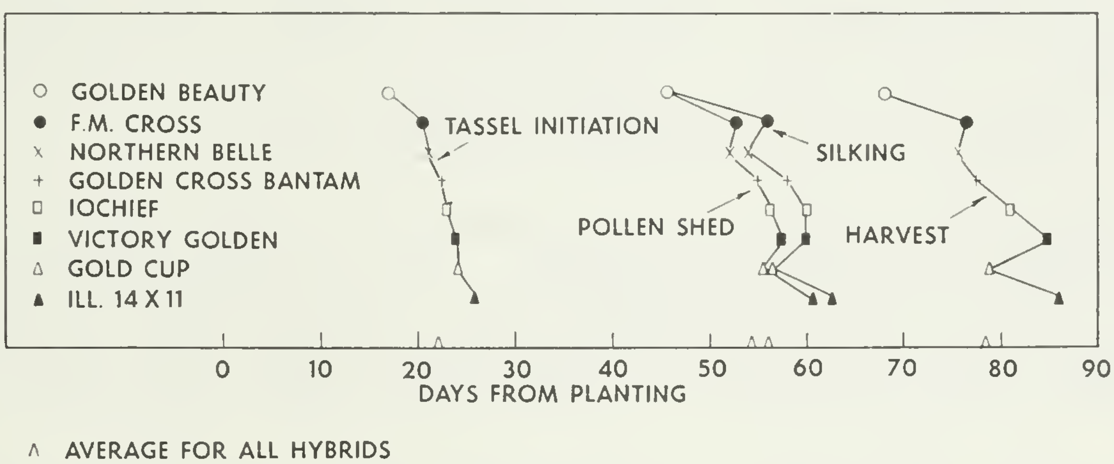


Fig. 1. TIME PATTERN FOR A MIDSEASON SWEET CORN

nteresting to note that two of the important events that affect the time of harvest, tassel and ear initiation, occur underground. The time of their occurrence can be estimated roughly by the number of days after planting, but more accurately y the number of leaves that are visible.

he time to harvest is also influenced by genetic differences among cultivars. ere are some examples of the factors that are or are not involved. Seed weight as no effect. It does not determine whether the cultivar will be early, mid-eason, or late. Cultivars develop at different rates. This can be detected in he seedling stage by counting the leaves. The faster developers will have higher eaf counts. A high rate of development shortens the time to harvest. Cultivars ary in the number of leaves on the main stalk. Each additional leaf delays harvest by about 2 days. The number of kernels per row varies among cultivars. The arger the number the later the harvest. The number of rows on the ear have no ffect. Cultivars with a high potential yield tend to be later. The problem is omplicated by the fact that cultivars have different combinations of these characeristics. For example, one cultivar might have a high rate of development but a mall number of leaves. Another might have the reverse combination. Because of he counteracting effect of rate and total leaves, these two might reach harvest at he same time - but for different reasons. This complication is illustrated in igure 2. The cultivars are arranged in order of time to tassel initiation, but he pattern changes as further development takes place.



Days required for eight hybrids to reach various stages of development. **(Fig. 2)**

he time to harvest can also be influenced by environmental factors. In our experiments, Golden Cross Bantam has reached harvest in a range from 65 to 94 days. The rimary factor involved is temperature. Temperature affects the rate of development. The relationship changes from one phase of development to another, but has a continuing effect from planting to harvest. It also can affect the time to harvest by altering the number of leaves. This effect only occurs between the time of ood depletion in the seed and tassel initiation. (Fig. 1). High temperatures in his period increase the number of leaves. Moisture stress in the plant tends to ecrease the rate of development. Some cultivars, particularly those usually grown n the tropics, are quite sensitive to day length. Under the long days of our summer season they keep on producing leaves so that the harvest is greatly delayed.

n conclusion, the development of sweet corn is a very complex thing not only in he weird sequence of events that occur, but also the way it reacts to hereditary nd environmental factors.

VEGETABLE INSECT SITUATION - 1977

Roscoe Randell

General - The 1977 growing season began in late March and continued 15 to 20 days ahead of the average season through June, and 10 to 12 days ahead in July and August Development of overwintering insects emerging in the spring and summer were also muc ahead of average.

Corn Insects - European corn borers overwintering from 1976 into 1977 were very low in numbers. Successful first-generation moth flight in May and egglaying and larval survival on early planted corn created a higher potential for a second generation tc emerge in late July and early August. Increased corn borer numbers, an extended second generation, and an additional full third generation of borers in the souther half of the state and a partial third in the northern part, allowed corn borer numbers to be high in late fields of sweet corn. Some fields of late planted sweet coi had heavy third-generation egglaying and hatch.

Corn earworm overwintered successfully in the southern one-fourth of the state. Th first generation was observed in the earliest plantings of sweet corn harvested in June. Migrating earworms first arrived over the entire state during the week of August 4 and numbers remained moderate through September.

Fall armyworms, a common pest of late planted field corn, was above average in numbers in most areas of the state in August. With few late fields of field corn, these worms attacked late season sweet corn. A two or three day interval spray schedule using Sevin as the insecticide did not control fall armyworms, especially where the worms fed in the whorl and then traveled down the stalk to enter the side of the ear.

Black cutworms appeared early in the spring in some areas of the state and fed on young plants of early planted sweet corn. Corn rootworm adult beetles were commonl found in late sweet corn fields in the northern half of the state. The beetles emerged from the soil where corn was grown for two or more year in succession. Lat on they migrated to nearby late maturing fields to feed on the fresh silks, pollen and leaves.

Overwintering corn borers are much higher for the winter of 1977-78 than one year ago (Map 1). The potential for a first generation in the spring is dependent on successful overwintering in relation to harvesting, stalk destruction by shredding tillage, winter climate, and climate at moth emergence in May and June. Corn root worms have increased within recent years and populations were the heaviest ever recorded in 1977. This insect will be a pest again in 1978 in the northern two-th of Illinois in fields where corn has been grown for two or more years in successio

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Cabbage and Related Crop Insects - Imported cabbage worms appeared in high numbers on early cole crops. White butterflies (adult) were numerous in June. Cabbage looper moths appeared in light traps in July and reached their peak activity in late August. Since Galecron and Fundal are no longer labeled for control of cabbage worms, the only alternatives for looper control are Lannate or Nudrin, *Bacillus thuringiensis*, or Monitor. *Bacillus thuringiensis* was effective in 1977 if applied every 5 to 7 days. Monitor was restricted in usage by its 35-day harvest limitation on cabbage.

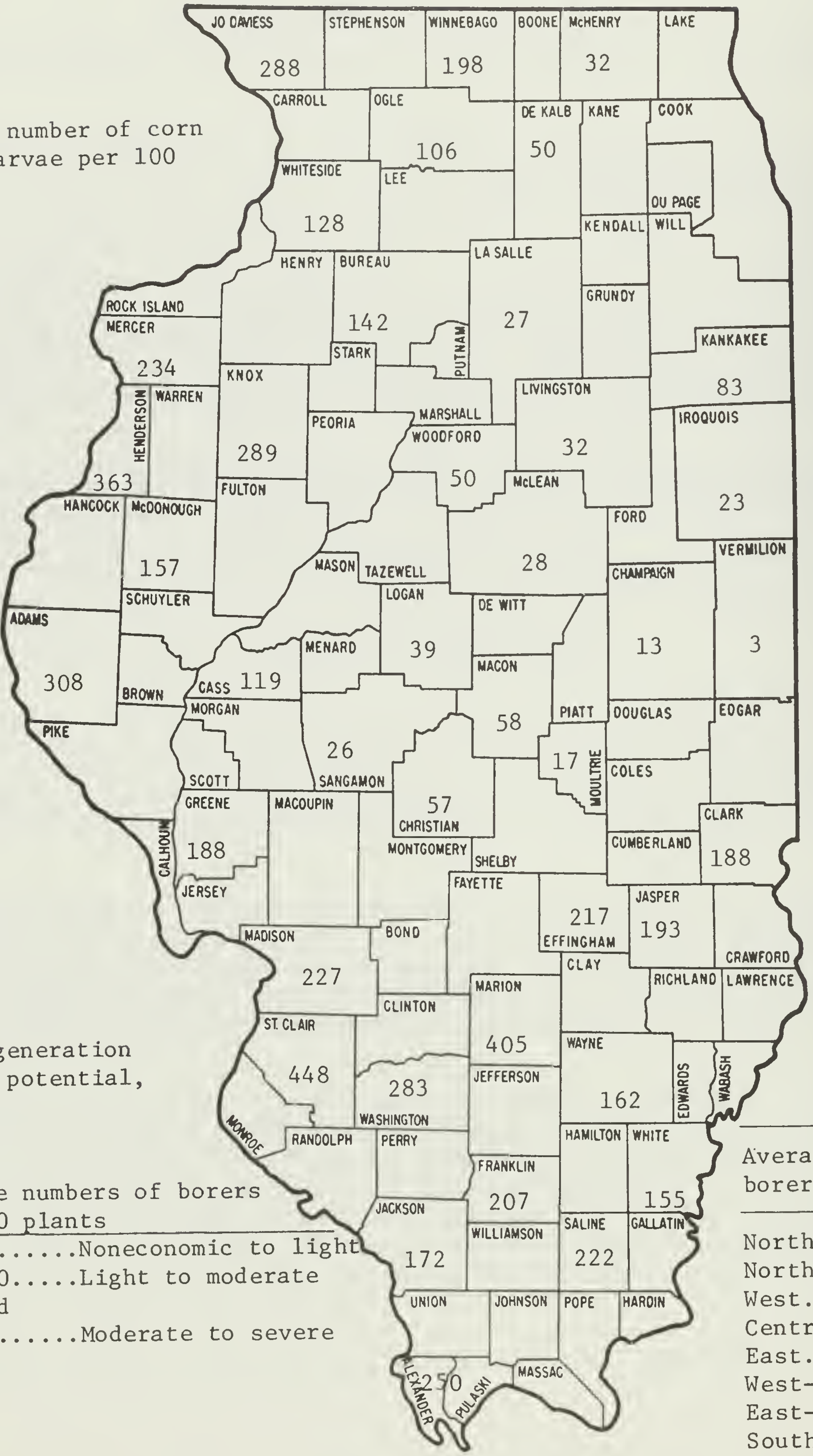
Bean Insects - Leafhoppers arrived early in 1977 and were common in snap and lima beans by mid-May. These hoppers continued to migrate from clover and alfalfa to vegetable crops throughout the summer.

Green cloverworm is a common looper-like insect on soybeans. Generally, there is only one generation which disappears in early August. This past season there was a second generation of green cloverworms attacking soybeans in large numbers in some areas, and they also were found in edible beans. Third-generation corn borers attacked snap beans in late August and September. High numbers of borers and severe damage was commonly found in late season beans. Methomyl gave fair to poor control of these borers in late season snap beans.

Cucumber and Melon Insects - Striped cucumber beetles successfully passed the winter as adults despite the sub-zero temperatures. The beetles migrating to newly emerging cucumber, squash, and melon plants fed on the new leaves. In some areas in the southern part of the state, there was transmission of bacterial wilt to these new vine crop plants.

Map 1. European Corn Borer Prospects for 1978

Average number of corn borer larvae per 100 plants



First-generation damage potential, 1978

Average numbers of borers per 100 plants

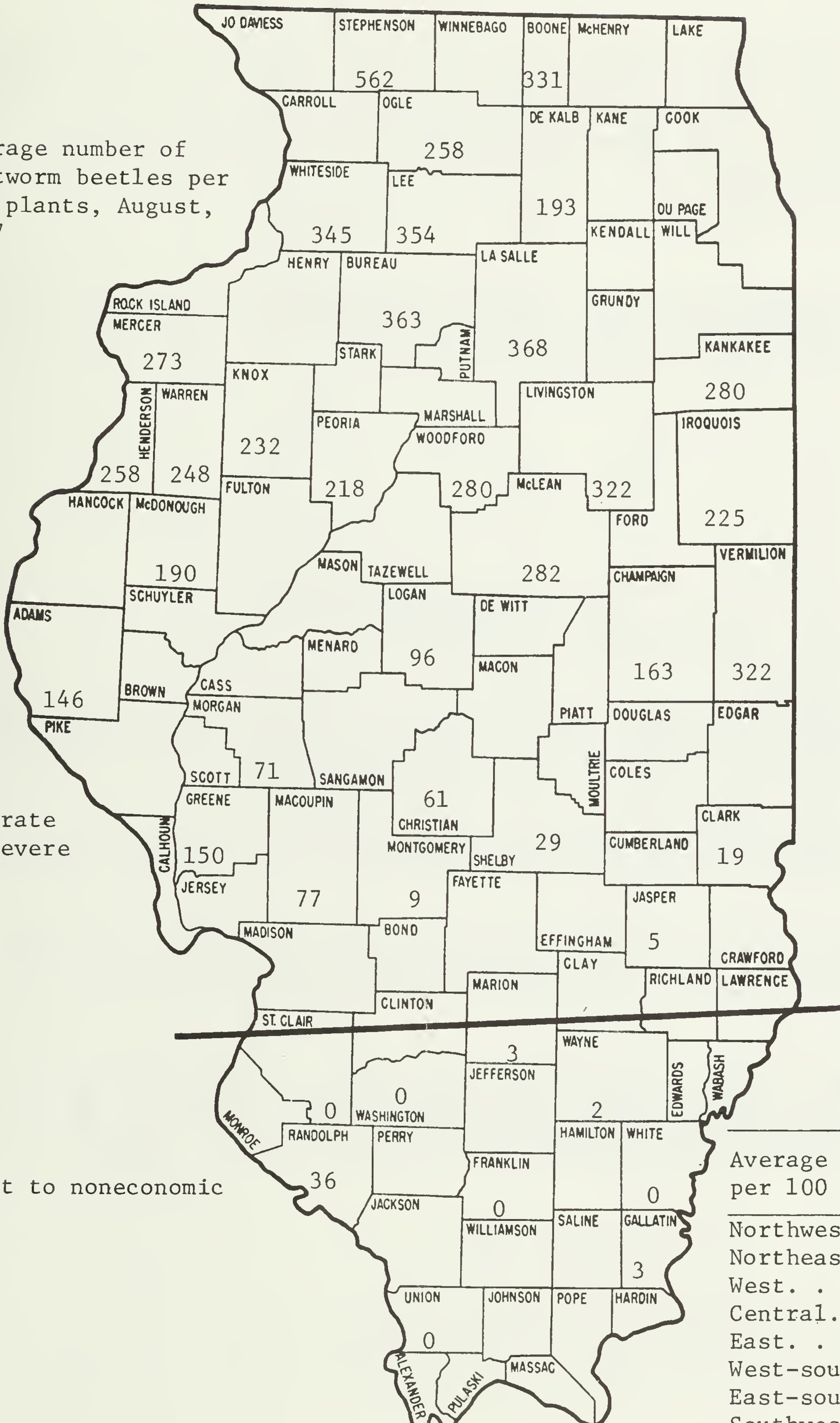
0-100.......Noneconomic to light
100-250.....Light to moderate
250 and over........Moderate to severe

CORN BORER POPULATIONS BY DISTRICTS FALL, 1977

Average number of borers per 100 plant	
Northeast.........	18
Northwest.........	3
West..............	27
Central...........	4
East..............	3
West-southwest....	12
East-southeast....	20
Southwest.........	28
Southeast.........	18
STATE	1

Map 2. Western and Northern Corn Rootworm Prospects for 1978

Average number of rootworm beetles per 100 plants, August, 1977



Moderate to severe

Light to noneconomic

ADULT ROOTWORM POPULATIONS BY DISTRICTS AUGUST, 1977

Average number of beetles per 100 plants	
Northwest	358
Northeast	298
West	215
Central	219
East	262
West-southwest	74
East-southeast	14
Southwest	9
Southeast	0

10 fields surveyed in counties indicated

1977 INSECT CONTROL IN FRESH MARKET SWEET CORN

University of Illinois Vegetable Crops Farm

Ten treatments plus an untreated plot were established in a stand of late sweet corn. Single row plots with a border row between each treated row and four replicates per treatment were established. Gold cup sweet corn was planted July 8. The first spray date was August 20 at 10 percent silk and five more sprays were applied every two days thereafter. Twenty five ears were examined in each of four replicates of each treatment (See Table 1).

Results

The synthetic pyrethroids Pydrin and Pounce were the most effective earworm insecticides while methomyl was the most effective of labeled insecticides. Elcar virus, a polyhedrosis virus, was ineffective.

1977 CABBAGE WORM CONTROL

University of Illinois Vegetable Crops Farm

Eight insecticide treatments plus an untreated plot were established in a transplanted patch of Market Prize cabbage. There were three rows of cabbage with seven plants in each row. There were three replicates of each treatment.

The cabbage plants were transplanted May 31 and June 1. The spray program began June 14 and continued on nearly a ten day schedule for a total of six applications through August 2.

Damage ratings of the heads in each plot were made on August 15 and three heads in the center row of each plot were examined for insects (See Table 2).

Results

Heads examined in plots treated with either Orthene or Pounce rated the least free of worm damage. Lannate and Dipel were the only labeled insecticide included in the test. The sunlight masking pigment added to Dipel did not improve its insecticidal activity.

TABLE 1. 1977 INSECT CONTROL PLOTS IN FRESH MARKET SWEET CORN

Roscoe Randell, Extension Entomologist
University of Illinois

Location: University of Illinois Vegetable Crops Farm, Urbana
Variety: Gold
Plot layout: 4 randomized single row plots--50 feet long per treatment--border row between each treated row
Planted: July 8, 1977
Spray application dates: August 20, 22, 24, 26, 28, and 30
Harvest date: September 6, 1977
Application equipment: Backpack CO_2 sprayer with 2 nozzles directed at each side of treated row. Approximately 40 gallons of finished spray per acre were applied.

Treatment	Rate a.i./a.	Percent worm-free ears	Corn borers		Percent damaged			Corn earworms		Percent damaged		
			in silks	on kernels	tip	side	tip & side	in silks	on kernels	tip	side	tip & side
Imidan 50W	1 lb.	16	21	-	1	-	-	39	100	63	1	20
Imidan 50W & Sevin 80S	1/2 lb. 1.25 lb.	38	24	2	-	1	-	44	50	53	-	9
SD 43775 3.2 lb. (Pydrin) per gal.	0.2 lb.	67	3	3	2	-	1	9	15	29	-	4
Sevin 80S	1.76 lb.	45	16	2	1	1	-	47	65	43	1	11
FMC 33297 3.2 lb. (Pounce) per gal.	0.1 lb.	70	4	2	1	2	2	7	12	21	-	4
methomyl 1.8 lb. per gal.	0.45 lb.	65	2	5	4	1	-	14	19	24	2	3
CGA 15324 4 lb. per gal.	3/4 lb.	54	3	2	3	-	-	43	38	42	1	3
Elcar virus	1/4 lb.	1	21	7	2	4	1	16	142	70	-	22
Virus & methomyl	1/4 lb. 0.22 lb.	56	8	2	2	-	-	74	30	35	1	8
Sevin SL2 2 lb. per gal.	1.76 lb.	27	42	2	-	3	1	34	52	57	1	18
Untreated	-	0	49	7	3	4	1	38	171	69	1	27

TABLE 2. CABBAGE WORM CONTROL PLOTS, 1977
Roscoe Randell, Extension Entomologist
University of Illinois

Variety: Market Prize
Planted: April 15, 1977
Transplanted: May 31, June 1
Spray dates: June 14, 23, July 1, 11, 21, Aug. 2
Harvest date: August 15, 1977
Plot size: Three row plots with seven plants per row. Three replicates per treatment.
Insect counts: Three plants per replicate from center row of plot.

Treatment	Rate a.i./a.	Damage rating[1/]	Average head wt.	Number of cabbage worms per head							
				I. C. W.				C. L.			
				S	L	P	PC	S	L	P	PC
Pounce FMC 33297	0.1 lb.	2.16	4.1	0	0.3	0	0.67	0.33	1.0	0.33	2.0
Lannate	.45 lb.	5.67	3.52	0	0.33	0.33	0.67	7.0	6.33	3.0	3.33
Orthene	1.33 lb.	1.83	4.72	0	0.33	0.33	0	3.33	1.33	1.0	0.33
SD 43775 (Pydrin)	0.2 lb.	1.67	4.40	0	0	0.33	0	0	0	1.0	0
CGA 12223	1.0 lb.	6.67	3.90	0	0.33	1.0	0.33	10.33	8.33	5.33	3.67
Dipel	1.0 lb.	3.67	3.34	0.67	0	0	0.33	6.67	4.33	1.67	2.0
CGA 15324	1.0 lb.	3.17	3.61	0.33	0.33	0.33	0	3.0	3.67	8.67	4.0
Dipel Pigment	1.0 lb. 1.0 lb.	4.17	3.75	0.33	0.33	1.0	0.67	10.33	2.33	2.67	2.33
Check	-	9.0	4.73	0.33	4.0	0.66	1.0	4.66	2.0	4.33	1.33

1/ Based on a rating scale of 1 to 10. 1 = no damage. 10 = most severe damage.

1977 SQUASH BUG CONTROL PLOTS

Squash bugs can be a serious insect pest of pumpkin and other vine crops. Chemical control is often difficult especially when mostly adult bugs are present. Squash bugs overwinter as adults near the field where they were present the previous season.

Chemical control tests were applied in 1976 to replicated plots in a field of canning pumpkin. The synthetic pyrethroids, Ambush and Pydrin gave effective control.

In tests applied in 1977, parathion at one half pound active ingredient per acre and Dylox at the rate of one pound per acre were applied to a field of canning pumpkin. The insecticides were applied by fixed winged aircraft with three gallons of water per acre added to the insecticide. In Table 3 below are the pre- and post-counts of squash bugs per square foot. Five replicates were counted in three locations of each insecticide treated plot. Dylox was somewhat more effective than parathion. Both parathion and Dylox are labeled for use on pumpkin.

Table 3. Squash Bugs Per Square Foot of Pumpkin Field

Insecticide	Location	Pre-spray	Post-spray - 24 hrs.
Parathion	E	125	16
	C	72	34
	W	71	36
Dylox	E	120	20
	C	73	11
	W	70	18

1978 WEED CONTROL STATUS IN VEGETABLE CROPS FOR ILLINOIS

H. J. Hopen

October 1977 was designated by the Environmental Protection Agency (EPA) as the time deadline to classify pesticides into restricted and general use materials. From the preliminary lists which have been circulated, a small portion of the herbicides used on vegetable crops in Illinois are on this list. We will keep you informed of any changes by means of the Illinois Vegetable Farmers' Newsletter which is available as a subscription and can be obtained by writing to Newsletter, College of Agriculture, 116 Mumford Hall, University of Illinois, Urbana, Illinois 61801.

Some of the following comments are meant to point out to you progress and suggestions in herbicide use for 1978 and should be used in combination with the grower's awareness of the problems that he has in his field. To be aware of our weed problems means that we need to monitor the weeds that are in the fields not only during the growing season but make a note of this after the crop is harvested so we know what we're shooting at for control the next year.

Whether to use herbicides or other means of weed control depends in part on the grower's experience with past year weed infestations; in many instances, mechanical control is sufficient to control weeds. However, there are also many instances where herbicides need to be used in addition to mechanical weed control.

Where one herbicide will not control the weeds present, you may have to use a combination of herbicides such as we suggest for cucumbers, melons and watermelon.

We've suggested some new herbicides which might be well to consider for 1978 and when using an herbicide for the first time, use a small scale trial on your own field to see how it will work. You can accomplish leaving a "check" area by simply turning off the sprayer for a short distance and seeing what weeds are actually present without an herbicide application.

Relative to individual crop species and herbicides which are available and which we have completed several years of work on: *These comments are made in reference to Circular 907 "Herbicide Guide for Commercial Vegetable Growers - 1978" and should be used in conjunction with this circular.*

Asparagus. Amiben continues to be the one material which is cleared for use on seedling asparagus. There is currently work being carried out with Lorox in the Midwest for this purpose. Amiben does well on our heavier type soils but Lorox

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H. J. Hopen is a Professor and Extension Specialist in Vegetable Crops, University of Illinois.

should perform better on lighter type soils. For established asparagus, Karmex and Princep continue to be the materials which are widely used for residual weed control. The amine of 2,4-D can be used for spot treatment for broadleaf control in asparagus but these applications should be applied with care because if they are applied on the spears, you can get distortion of the asparagus spears. Together with a number of other states, we have carried out work with use of Paraquat for use in minimum tillage in asparagus. This is currently being processed by the Inter-regional-4 Committee (IR-4) for clearance and it is not cleared for use at this time. The rationale in using this as a treatment is that this would reduce the number of discings which would be needed and, therefore, possibly give protection of crown damage.

Beans. The horticultural beans which we grow in Illinois include lima, dry, kidney, and snap beans. There are a wide array of materials which can be chosen from for control of weeds on the several soil types where these beans are grown. The most widely used choices are Premerge-3, Treflan, Eptam and Amiben. There should be a choice within these herbicides that would fit the soil type and the bean species which you are concerned with. The past several years we have worked with the current soybean herbicide Basagran for control of broadleaf weeds, nutsedge, and Canadian thistle. Basagran can be used effectively early post-emergence for broadleaf control. This herbicide would fit well together where the primarily grass active herbicides such as Treflan or Eptam are used, and there are a number of broadleaf weeds which develop later in the growing season. There is hope of having Basagran registered in the near future for lima bean weed control, and we are also enthused about this material for control of broadleaves, nutsedge and Canadian thistle in peas.

Sweetcorn. Atrazine, Lasso, propachlor, Sutan+ continue to be herbicides used singly or in combination with good results for sweetcorn production in Illinois. Bladex is an herbicide which has been used in Illinois to reduce soil residue from the triazine herbicides. The company which manufactures Bladex suggests that this material be used only by people experienced in using herbicides for sweetcorn production. Bladex should not be used on light or sandy soil areas where sweetcorn is grown. Bladex does not have as good a tolerance on sweetcorn as does atrazine and, therefore, the rates should be carefully controlled when it is used for weed control in sweetcorn. Eradicane is an herbicide where phytotoxicity can be a problem in some instances, but it is an herbicide which will give some control of problem weeds such as wild cane, nutsedge, quackgrass and seedling Johnson grass. This is a material then that should be considered for use where these weeds are a problem. For perennial grass control in sweetcorn, Roundup has shown good control, and this is an herbicide that can be made use of during the non-growing season for control as quackgrass and Johnson grass. Basagran has been suggested for trial use in sweetcorn this year for the control of nutsedge in sweetcorn.

Cucumbers, Muskmelons, Watermelons. Prefar plus Alanap continues to be an effective material for control of weeds in these vine crops, and this year the herbicide Vegiben-2E will again be manufactured and available. Vegiben-2E is a broad spectrum herbicide and should be used on our heavier textured soils in the state where the cucumbers and melon crops are grown. However, there is a definite possibility of injury on lighter soils with this material, and here Prefar plus Alanap is the best choice. An alternate choice to the use of herbicides in the vine crops in Illinois is the use of black polyethylene mulch where weeds are controlled by preventing the light from reaching the weed seedlings while they are germinating and in early growth stages. Black polyethylene mulch also conserves soil moisture and increases early spring soil temperatures for the growth of these warm season crops and this is an advantage in obtaining early yields.

Peas. We have spent several years working with several herbicides for control of the pea root rot complex and in these trials, which we have conducted in various places in the State of Illinois, we have been able to get some control of the *Aphanomyces* species with herbicides such as Treflan and Cobex. However, the best control of the total root rot complex which we have in Illinois has been accomplished with Premerge-3 when incorporated into the soil at normal depths. At the present time, none of these herbicides have a label for this use, but hopefully this may be an area where we can obtain this type suppression of root rot in the future.

Pumpkin. Amiben is the standard material which is used on our heavier type soils in Illinois for weed control in pumpkin. In cooperation with some of the pumpkin processing companies in Illinois we are currently in the process of obtaining a clearance of propachlor for weed control in pumpkin. This petition is currently being processed by the IR-4 Committee with the cooperation of the Monsanto Chemical Company.

VEGETABLE CULTIVAR TRIALS

J. W. Courter

ommercial growers and gardeners can often improve yield, time of harvest maturity, uality, and disease resistance by selection of proper cultivars. Many new ultivars are grown and performance tested each year for adaptability to Illinois.

ethods. New vegetable cultivars were evaluated at the Dixon Springs Agricultural enter. The soil is Grantsburg silt loam and the plots were irrigated as needed. he planting dates, plant and row spacings and harvest dates accompany Tables 1 hrough 8. Seed sources are given on page 51.

esults. The yields and performance of caged tomatoes, peppers, eggplant, summer quash, muskmelons, and sweet corn cultivars are given in Tables 1 to 8. See the eferences for comparisons with cultivar performance in previous years. The ollowing new cultivars are *worthy of trial* by commercial growers, especially in he southern half of Illinois (see pages 73-77 for recommended varieties).

ggplant - Jersey King, Dusky. Muskmelon - G-25VB, A & C Hybrid, Luscious, Star rek, Early Crenshaw. Pepper - Better Bell, Early Prolific, Florida VR-2, Goldmith 77-29, Hybelle. Summer Squash - Golden Zucchini, Eldorado, Market King, callopini (local market). Sweet Corn - Honeycomb (local market), Sugar Loaf (local arket), Golden Gleam, Cherokee, Bellringer, Bonanza, Gold Lady. Tomato - Big Girl, ragger (local market or home garden plant trade), Show-Me (31-ST-34), Floramerica local market), Sunripe.

ther vegetables observed (yields not reported here): Cabbage - Defender, uardian, Savoy Ace (local market). Watermelon - Sweet Favorite, Seedless xp. #20.

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TABLE 1. YIELD AND FRUIT SIZE OF TOMATO CULTIVARS GROWN IN WIRE CAGES, 1977[1]

Cultivar	Source	Early yield[2]	Total yield[2] No.1	Total yield[2] Mkt.	Fruit size	Culls	Notes[3]
		(*lbs/pl*)	(*lbs/pl*)		(*oz*)	(*no/pl*)	
Bragger	G	6.9	3.3	23.3	13.1	5.0	FW, CF
Show-Me (31-ST-34)	UM	8.7	8.7	20.3	8.6	4.4	Firm
Terrific	P	9.5	4.0	19.8	7.0	5.8	C
33-ST-34	UM	4.3	6.3	19.5	8.5	1.2	Firm
Super Fantastic	BA	10.5	3.7	18.6	7.8	7.3	C
Imp. Walter	AC	7.4	4.0	18.5	6.1	11.0	CF
Floramerica	PS	7.1	4.0	18.4	10.6	6.6	SD, C
Setmore	H	10.8	5.7	17.2	7.1	11.2	D, CF
Parks Whopper	P	8.7	5.0	16.8	7.7	11.6	
Jet Star	H	9.1	3.3	16.6	8.8	5.3	C
Supersonic	H	7.7	2.7	16.3	8.7	4.8	G
Better Boy	BA	6.8	4.4	15.7	9.4	3.6	C
Henry Field	HF	6.9	3.0	15.7	6.8	9.4	FW
Sunripe	BA	10.4	3.4	15.5	7.8	4.3	D, C
Hybrid #20	FM	9.1	5.1	15.5	7.0	5.8	D
Traveler	BA	6.0	9.2	15.4	5.3	2.2	
33-ST-36	UM	8.2	4.7	15.4	8.2	2.6	
Pink Wrap	H	5.0	8.4	15.3	5.5	2.2	
He-Man	G	3.0	2.6	15.0	8.7	5.0	C
Royal Flush	T	11.3	3.0	14.9	8.1	9.2	D
7818VF	PS	6.4	4.9	14.7	7.5	2.8	CF
Ace Hybrid	PS	4.8	3.4	14.3	9.0	2.4	
Pole Boy	AC	1.2	6.6	14.1	8.1	6.0	C
36-ST-30	UM	4.5	2.9	13.7	10.6	4.0	CF
LAR-2	H	6.6	4.3	13.4	8.6	10.4	CF, C
NFV-22	H	7.0	1.1	12.8	8.5	15.1	D, CF, C, G

(*continued*)

TABLE 1. YIELD AND FRUIT SIZE OF TOMATO CULTIVARS GROWN IN WIRE CAGES, 1977[1]

Cultivar	Source	Early yield[2]	Total yield[2] No. 1	Total yield[2] Mkt.	Fruit size	Culls	Notes[3]
		(lbs/pl)	(lbs/pl)		(oz)	(no/pl)	
Campbell 1327	H	9.0	1.4	12.6	8.2	8.2	D
36-ST-8	UM	9.3	2.5	12.5	7.3	6.6	
IXV-22	H	7.0	1.4	11.7	6.1	27.4	D, CF
Castlex 1011	C	2.5	1.8	11.3	7.5	7.4	D, G
Burpee VF[4]	BUR	2.6	2.7	10.7	8.1	5.6	
Red Pak	H	6.2	1.8	10.2	7.9	12.3	D, CF, G
Big Girl[4]	BUR	1.2	2.4	10.0	6.2	2.4	C
Early Girl	BA	9.7	0.0	9.8	4.5	37.8	FW
Big Johnny	AC	5.7	0.4	9.5	7.1	24.2	D, G
Big Early[4]	BUR	3.7	0.6	9.2	7.6	18.2	FW, C
Sir Walter	AC	3.5	2.6	8.3	6.2	9.4	D, G
Auburn-76[4]	AU	0.5	3.7	7.2	6.0	1.2	
Burgess Trpl Crop	B	3.7	0.5	6.3	12.9	10.0	FW, CF
Big Boy[4]	BUR	1.8	0.8	5.7	7.9	11.0	FW, C
Stakless	T	0.6	0.0	3.5	8.7	10.0	D, G
HY-X	HF	2.2	0.0	2.2	7.5	31.2	D, FW
NH 212	UNH	1.6	0.0	1.8	6.1	25.6	D, FW

[1]Seeded April 11, 1977; transplanted May 11, 1977; spacing 6 x 2 feet
[2]Harvested early yield July 15 to July 29, 1977; total yield July 15 to August 15, 1977
[3]Abbreviations: C = fruit cracking; CF = catfacing; FW = fusarium wilt; D = determinate; G = graywall; SD = semi-determinate
[4]Seeded April 27, 1977; transplanted May 16, 1977

TABLE 2. PERFORMANCE OF PEPPER CULTIVARS, 1977[1]

Cultivar	Source	Early yield[2]	Yield[3] U.S.No.1	Yield[3] Total Mkt.	Fruit size	Notes
		(%)	(bu/acre)		(oz)	
Lady Bell	H	42	772	1081	5.0	
Sweet Banana	H	46	763	763	1.1	
Exp. 77-29	G	38	701	1033	3.9	
PSR 275	PS	40	593	593	1.1	pointed yellow
PSR 375	PS	31	510	877	6.0	some huge elongated peppers
#29	UF	50	485	774	4.3	
PG	C	54	483	826	4.4	
Better Bell	BA	37	481	969	4.3	
A & C Calif. Wonder	AC	40	452	813	4.6	
Bellringer	BUR	36	448	751	4.5	
VR-2	UF	38	425	736	4.7	
Sonnette	MSU	43	404	913	4.1	
Keystone Res. Giant	T	42	398	792	4.7	
Hybelle	H	53	394	714	4.8	
Starr	N	34	382	685	5.3	
H-63	AC	39	363	776	4.8	irregular shape, many 3 lobes
EG	AC	52	355	751	4.3	
Early Prolific	G	63	337	774	3.3	small
PSR 175	PS	57	307	653	4.0	
Tasty Hybrid	BUR	23	247	546	4.4	
KRG-3	K	60	189	458	3.9	3 lobes
Ace Hybrid	SS	38	160	429	4.1	
Earliest Red Sweet	SS	28	21	448	2.0	

[1]Seeded 4/19/77; transplanted 5/25/77; spacing 6 x 2 feet
[2]Yield of first two pickings as a percentage of total marketable yield
[3]Harvested 7/26/77 to 8/30/77 (4 pickings)

TABLE 3. PERFORMANCE OF EGGPLANT CULTIVARS, 1977[1]

Cultivar[2]	Source	Yield[3]	Fruit size
		(*lbs/plant*)	(*oz*)
Black Bell	PS	14.1	12.7
Long Black Beauty	T	13.8	16.2
Midnite	PS	13.0	11.7
PSR 6175	PS	12.8	12.5
Burpee Hybrid	BUR	12.6	11.7
Jersey King Hybrid	BUR	12.5	9.7
Keystone Purple Jewell	K	12.1	12.1
Black Magic	H	11.7	11.8
JKBSR	H	11.6	9.1
54BSR	H	11.3	14.1
Peerless	T	11.1	8.9
BSCAM	H	9.7	8.1
Classic	H	9.6	10.6
BS 68/96A	H	9.5	9.3
Black Beauty	BUR	9.2	9.2
Special Hybush	H	8.9	11.4
Blacknite	BA	8.6	9.6
Early Beauty Hybrid	BUR	7.9	6.4
Black Knight	T	7.9	9.5
Black Jet	T	7.7	13.5
Dusky	H	7.7	10.0
Florida Market	T	7.7	12.8
701 Pintung Long	KY	6.2	5.3
Ichiban	BA	5.8	4.3

[1]Seeded 4/19/77; transplanted 5/25/77; spacing 6 x 2 feet
[2]All cultivars were inoculated with verticillium wilt (*Verticillium albo-atrum*) in greenhouse tests and found to be susceptible (Dr. B. J. Jacobsen)
[3]Harvested 7/15/77 to 8/16/77

TABLE 4. PERFORMANCE OF SUMMER SQUASH CULTIVARS, 1977[1]

Cultivar	Source	Early yield[2]	Fruit size	Characteristics
		(lbs/plant)	(oz)	
Goldzini	PS	8.7	6.3	light yellow straightneck
Golden Girl	H	8.2	6.3	light yellow straightneck
Eldorado	H	7.7	6.9	bright yellow zucchini, tends to have green blossom ends
Market King	K	6.9	11.6	dark green zucchini
Ingot	K	6.7	5.2	light yellow straightneck
Moneymaker	K	6.1	4.4	yellow crookneck
Sundance	PS	5.9	5.1	bright yellow crookneck
N2	H	5.7	10.1	very long medium green
Scallopini	PS	5.1	7.2	
Patty Pan Green	PS	4.6	8.2	light green scallop
Burpee's Golden Zucchini	BUR	4.2	6.0	bright yellow zucchini

[1]Seeded 6/1/77; transplanted 6/10/77; spacing 6 x 3 feet.
[2]Harvested 7/8/77 to 7/28/77.

TABLE 5. INCIDENCE OF BACTERIAL WILT INFECTION IN SELECTED MUSKMELON CULTIVARS[1]

B. J. Jacobsen and J. J. Faix

Bacterial wilt of cucurbits, caused by the bacterium *Erwinia traechelphila*, is the most serious disease problem of muskmelons and cucumbers in Illinois. This bacterium is spread and overwinters inside striped and twelve spotted cucumber beetles. This disease is controlled through spray programs to eliminate the insect vector. Despite weekly applications of insecticide bacterial wilt was especially severe in 1977 and losses ranged from 0 to 100% (see below and Table 6). The lower disease ratings for certain muskmelon varieties may be due to differential insect vector feeding or to actual disease tolerance. Further studies on bacterial wilt tolerance are planned for 1978.

Cultivar	Early Yield[2]	Wilt infection: Plants[3]	Wilt infection: Severity Index[4]
	(melons/plot)	(%)	
Saticoy	40	10	0.3
Supermarket	37	40	1.0
Gold Star	28	0	0
Sampson	28	90	2.3
Harper Hybrid	23	30	0.5
Kangold	11.5	60	2.0
New Edisto 47	0	90	4.0
Planter's Jumbo	0	100	3.8

[1]Transplanted 5/1/77; 5 hills spaced 10 x 25 foot, clear plastic mulch.
[2]July 12 and 19, average of 2 replications.
[3]Percentage of all plants showing wilt symptoms on 7/7/77.
[4]Rating: 0 = no symptons, 1 = 20% of plant wilted, 2 = 40% of plant wilted, 3 = 60% of plant wilted, 4 = 80% or more of plant wilted.

B. J. Jacobsen is Extension Specialist, Plant Pathology and J. J. Faix is Assistant Professor of Agronomy.

TABLE 6. PERFORMANCE OF MUSKMELON CULTIVARS, 1977[1]

Cultivar	Source	Melons harvested	Average weight	First harvest	Bacterial wilt rating[2]
		(no.)	*(lbs)*		(%)
H-90	H	10	4.9	7/4	100
Exp. - #1	H	15	3.6	7/7	65
Exp. - #2	H	13	4.0	7/7	50
G-25VB	H	38	6.8	7/9	20
A & C Hybrid	AC	33	5.0	7/9	0
Minn. Midget	P	23	2.3	7/9	100
GQA/6036	H	15	4.6	7/10	30
G-25B	H	22	4.4	7/10	0
Harper Hybrid	H	14	4.4	7/10	100
Early Dawn	H	1	3.7	7/10	100
Saticoy	J	32	4.6	7/11	90
Wonderful King	KY	7	2.8	7/12	100
Star Trek (HXP 2472)	H	20	4.8	7/12	50
Luscious	P	38	5.8	7/12	50
Gold Star	H	23	5.2	7/12	15
Roadside	T	7	6.3	7/12	80
Burpee Hybrid	BUR	33	5.2	7/12	50
Alaska	PS	2	4.3	7/12	100
Zenith	K	18	5.1	7/13	100
Dixie Jumbo	PS	16	3.9	7/15	90
Honey Rock	HC	19	7.1	7/15	50
Ball "1776"	BA	11	5.2	7/15	50
Ambrosia	BUR	12	4.5	7/17	95
Early Crenshaw	BUR	2	8.9	7/19	100
Haogen	BUR	2	4.8	7/20	30
Short & Sweet	P	7	4.2	7/21	70
Banana	B	1	6.3	7/22	100
Cameo	K	10	5.1	7/25	50
Northern Queen	T	-	-	-	100
Sugar Ball	KY	-	-	-	100

[1]Seeded 4/12/77; planted 5/6/77; harvested 7/4 to 8/15/77; 5 hills (transplanted) spaced 5 feet apart, rows 12 feet apart, black plastic mulch

[2]Percent death of plants rated on 8/5/77. Saticoy and Luscious yielded until sudden collapse of the vines about August 1

TABLE 7. PERFORMANCE OF SWEET CORN CULTIVARS, 1977

Cultivar	Source	Date of first harvest	Ear characteristics: length	tip cover	wt. 6 ears	Yield[2]	Amount picked[2]	Notes
			(in)		(lbs)	(doz/ A)	(%)	
			Planted April 18					
libelle	H	6-27	7 1/4	F	3.6	1149	96	bird damage
udance	H	6-28	7	G	4.1	988	98	bird damage
. Xtra Sweet	I	6-28	7 1/4	G	4.3	631	100	poor stand
thern Belle	H	6-29	7 1/2	G	4.0	2096	100	
iance	NK	7-1	7 1/4	G	4.0	776	93	
melet	S	7-1	8	G	4.3	579	97	
eycomb	NK	7-3	7 1/2	G	4.6	1200	91	
d Cup	H	7-5	7	G	4.0	866	96	
bilee	R	7-5	7 1/2	G	4.9	414	91	
lringer	H	7-5	7 1/4	G	4.8	497	96	
rlet	S	7-5	8	G	4.7	715	90	
199	NK	7-6	7	G	4.1	694	88	
d Crown	H	7-6	8 3/4	G	5.4	957	93	
gar Loaf	NK	7-10	7 1/4	F	4.2	562	78	bird damage
ndyman	K	7-10	7 1/2	G	5.2	764	79	
lmark	NK	7-10	7 1/4	G	5.2	748	97	
lden Queen	R	7-12	7 1/4	G	4.5	1016	89	
lver Queen	R	7-15	8	G	5.7	1101	86	
			Planted May 24					
liance	NK	7-19	7 1/4	G	3.9	618	91	
199	NK	7-25	7 1/4	G	4.4	1478	83	
oneer	P	7-25	7 1/2	G	3.8	1129	94	
l. Xtra Sweet	I	7-25	7 1/2	P	5.2	519	72	poor fill
lver Queen	R	7-28	7 3/4	G	4.2	940	90	
lden Queen	R	7-28	7	G	4.2	445	73	poor fill

ip cover ratings: G = good, F = fair, P = poor

[2] arvested by U-pick customers.

TABLE 8. OBSERVATION OF SWEET CORN CULTIVARS, 1977[1]

Cultivar	Source	Date of first harvest	Ear characteristics length	tip cover	wt. 6 ears	Comments
			(in)		(lbs)	
EB405	H	7-21	7	P	4.2	
25-1961	R	7-21	8	F	4.0	ears not filled
75-2610	R	7-21	7 1/2	G	4.6	
NCX2012	N	7-21	6	G	4.2	
NCX2015	N	7-21	5 1/2	F	2.8	small ears
NCX2019	N	7-21	6 3/4	G	3.6	
3244	NK	7-21	7 1/2	G	4.6	
1101	H	7-25	7 3/4	G	4.2	
Golden Gleam (W9625)	H	7-25	8 1/4	G	4.8	poor tip fill
75-2084	R	7-25	6 3/4	G	4.0	
75-1719	R	7-25	6 3/4	F	4.8	tip worms
75-2294	R	7-25	7 1/4	G	4.6	
74-1921	R	7-25	6 3/4	G	4.0	
74-3044	R	7-25	7 3/4	G	4.8	looks good
72-2945	R	7-25	7 1/4	G	3.8	slender ears, "sweet"
70-2238	R	7-25	7	G	5.4	
Golden Delicious	HF	7-25	7 3/4	F	4.1	
2583	NK	7-25	7 3/4	G	4.4	looks good
Sugar King	SS	7-25	7 1/2	F	4.4	poor ear fill
A & C - 18	AC	7-25	7 1/4	F	4.4	
W9315	H	7-28	8	G	3.7	looks good
H445	H	7-28	7	G	3.7	poor tip fill
Y-81	HF	7-28	8	G	3.9	looks good
3272	NK	7-28	7 1/2	G	4.0	poor stand
Gold Lady (LM-11)	S	7-28	9	P	3.7	slim ear
Lancer (LM-8)	S	7-28	7 3/4	G	4.5	looks good
EM-12	S	7-28	7 1/2	P	3.7	not filled out, poor stand
#7597	K	7-28	7 1/4	G	3.6	slight bi-color
Buttersweet	K	7-28	7 3/4	G	4.3	tip worms
Golden Sweet EH	HO	7-28	8	G	3.7	poor ear fill
A & C #191-2	AC	7-28	7 1/4	G	4.0	poor tip fill, tip worms

[1]*Planted* 5/24/77

1977 SWEET CORN VARIETY TRIAL
Collinsville, Illinois

C. C. Doll and B. J. Jacobsen

Variety	Source	Virus infection[1]	Plant vigor[2]	Yield[3]	Days[4]	Ear quality[5]
		(%)		(no. ears)		
Aztec	A	27	6.7	12.0	63	poor ear fill
Bonanza	FM	37	9.3	14.3	70	poor ear fill
Comet	A	37	9.0	15.0	70	white, fair cover
74-3044	R	40	7.3	10.5	70	
Pageant	R	40	8.0	14.5	67	fair cover, pulls hard
H-445	H	43	8.7	10.3	70	
Commander	A	43	9.3	10.7	73	fair cover
XP 2500	A	43	9.0	12.3	67	
NK-199	NK	47	8.8	11.7	70	poor ear fill
EB-405	H	50	6.0	12.3	63	
Wintergreen	A	50	8.0	11.0	70	
Bellringer	H	50	8.0	15.0	67	
Rapidpak	FM	53	5.7	8.7	70	poor tip cover
Stylepak	FM	53	7.7	8.0	70	poor tip cover
Cherokee	A	53	8.3	10.3	67	
Capitan	A	53	8.7	11.0	75	poor ear fill
Hallmark	NK	57	8.0	11.0	73	poor tip cover & ear fill
Target A	FM	57	9.3	13.0	70	poor cover & ear fill

C. C. Doll is Area Extension Horticulturist and B. J. Jacobsen is Extension Specialist in Plant Pathology.

1977 SWEET CORN VARIETY TRIAL
Collinsville, Illinois

Variety	Source	Virus infection[1]	Plant vigor[2]	Yield[3]	Days[4]	Ear quality[5]
		(%)		(no. ears)		
Yukon	NK	60	7.0	8.0	67	weak stalk
Merit	A	60	9.7	13.0	67	fair cover
Sugar Daddy	FM	60	7.3	13.0	63	thin ear
Gold Cup	H	67	6.3	12.3	67	poor ear fill
68-2578	R	70	7.7	9.3	70	poor tip cover
Sugar Dots	FM	73	8.3	10.3	63	bicolor, poor tip cover
Patriot	F	73	9.0	6.0	73	poor ear fill, uneven maturity
Commanche	A	77	8.3	11.7	67	fair ear fill
Reliance	NK	80	5.7	9.7	63	poor ear fill
W9315	H	83	7.7	10.0	70	poor tip cover
Foremost	FM	83	8.0	11.3	70	
Midway	A	90	7.0	9.7	70	poor tip cover
XP 370	A	93	7.7	10.3	70	fair ear fill
Iobelle	FM	93	8.7	14.0	70	poor flavor

[1]Ratings of virus infections as percentage of plants infected on 6/19/77. Both MDMV and WSMV were present.
[2]Vigor rating of 10 equals most vigorous; 1 equals stunted; rated on 7/11/77.
[3]Yield of large marketable ears based on external appearance. Plot length of 14 feet with 14 seeds planted 12 inches apart.
[4]Early fresh market harvest during an accelerated growing season.
[5]Lack of comment indicates acceptable ear quality.

SEED SOURCES

We gratefully acknowledge the following companies and universities for seed used in these trials. Inclusion or exclusion of companies in this list does not constitute a recommendation. All of these companies do not sell seeds directly to commercial growers.

Code	Source and address
A	Asgrow Seed Co., Kalamazoo, MI 49001
AC	Abbott & Cobb, 4744-46 Frankford Ave., Philadelphia, PA 19124
AS	American Seedless Watermelon Seed Corp., Goshen, IN 46526
AU	Auburn University, Auburn, AL 36830
B	Burgess Plant & Seed Co., Box 218, Galesburg, MI 49053
BA	Geo. J. Ball, Inc., Box 335, West Chicago, IL 60185
BUR	W. Atlee Burpee Co., Box B-2001, Clinton, IA 52732
C	A. L. Castle, Inc., Box 877, Morgan Hill, CA 95037
CH	Charter Research, Inc., Box 787, Caldwell, ID 83605
CR	Crookham Company, Box 520, Caldwell, ID 83605
FM	Ferry-Morse Seed Co., Inc., Mountain View, CA 94040
G	Goldsmith Seeds, Inc., Gilroy, CA 95020
H	Joseph Harris Co., Inc., Moreton Farms, Rochester, NY 14624
HC	H. H. Connaway, Dix, IL 62630
HF	Henry Field Seed & Nursery Co., Shenandoah, IA 51601
HO	Holmes Seed Co., Box 9087, 2125 46th St. NW, Canton, OH 44709
I	Illinois Foundation Seeds, R-1, Tolono, IL 61880
J	J. W. Jung Seed Co., Randolph, WI 53956
K	Keystone Seeds, Hollister, CA 95023
KY	Known-You Seed Co., 26 Chung Cheng 2nd Road, Kaohsiung, Taiwan
MSU	Michigan State University, East Lansing, MI 48823
N	Niagara Seeds, FMC Corp., Middleport, NY 14105
NK	Northrup King & Co., 1500 Jackson St., N.E., Minneapolis, MN 55413
P	Geo. W. Park Co., Inc., Greenwood, SC 29646
PS	Petoseed Co., Inc., Box 4206, Saticoy, CA 93003
R	Rogers Brothers Seed Co., Box 2188, Idaho Falls, ID 83401
RS	Robson Seed Farms Corporation, Hall, NY 14463
S	Seedway, Inc., Hall, NY 14463
SS	Stokes Seeds, Inc., Box 548, Buffalo, NY 14240
T	Otis S. Twilley, Box 1817, Salisbury, MD 21801
UF	University of Florida, Gainesville, FL 32601
UM	University of Missouri, Columbia, MO 65201
UNH	University of New Hampshire, Durham, NH 03824

IRRIGATION PRINCIPLES AND COSTS FOR ILLINOIS

M. D. Thorne

Every section of Illinois normally receives more water as rain and snow during a year than it loses by evaporation from the soil and transpiration from plants. Nevertheless, there is never a year when soil moisture is not deficient for optimum crop growth sometime during the growing season.

Together, soil evaporation and plant transpiration are known as evapotranspiration. Potential evapotranspiration is the loss when conditions are more conducive to evaporation and transpiration.

In an average year, potential evapotranspiration exceeds precipitation from May to September. Crops will grow during this period if one or more of the following conditions prevail: (a) stored soil moisture is sufficient to make up the deficit during the growing period; (b) actual evapotranspiration is reduced appreciably below potential evapotranspiration; (c) additional water is added by irrigation.

Crops growing on deep soil with high water-holding capacity may get by quite well if precipitation is not appreciably below normal and if the soil is filled with moisture at the beginning of the season. Fine-textured soils with a high organic-matter content have good water-holding capacity.

Evapotranspiration can be reduced by getting fast early growth to help shade the soil, by mulching, or perhaps by transpiration retardants. When soil moisture is limiting, evapotranspiration is reduced, but yields are usually reduced also.

Periods of below-normal rainfall in the summer are also usually periods of above-normal temperatures and soil moisture may become severely limiting. Data from Iow State University have shown as high as 40 percent reduction in yield of corn from four consecutive days of visible wilting at the time of silk emergence. Their studies have also shown yield reductions of soybeans as high as 40 percent from drought during the week after pod filling begins.

Rain Probability in Illinois. It takes at least 20 inches of water to produce a good crop of corn in Illinois. Various sections of the state get from 10 to 15 inches of rain during the growing season. Thus, 5 to 10 inches of subsoil moisture are needed in an "average" year to produce the yields which we have come to think of as normal or satisfactory. If the rainfall during the growing season is below normal this year, more than 8 inches of stored soil moisture would be needed The result will be lowered yields, unless we can add additional water by irrigatio Unfortunately the probability of getting at least an inch of rain per week is lowest in all sections of Illinois during the time corn is normally pollinating -- the last half of July. Irrigation can prevent moisture deficiencies during this and other critical periods in crop growth.

M. D. Thorne is Extension Agronomist, University of Illinois.

Yield Increases from Irrigation. We now have three years of data from irrigation research on sandy soil in Mason County. Corn yields slightly higher than 200 bushels per acre were obtained in 1975 and 1976. The yields from nonirrigated land in the experiment for those years were 70 to 80 bushels. In 1974, the high yield was 180 bushels per acre; yields from nonirrigated land were not obtained in the experiment that year. Full-season soybeans yielded 55 and 45 bushels per acre in 1975 and 1976. The yields from nonirrigated land in those years were 30 and 16 bushels, respectively. Irrigated soybeans yielded 58 bushels per acre in 1974. No yields were taken that year from nonirrigated land. Double-crop soybean yields were obtained each year from plantings made the first week in July. The highest yields obtained for double-crop soybeans in each year ranged from 25 to 30 bushels per acre.

Another prediction of the yield increases that might be expected from irrigation in Illinois if the stored soil moisture plus rainfall are inadequate can be obtained by using the crop model developed at University of Illinois and University of Missouri during the past few years. This model is being used to predict corn yields at various locations in the Midwest.

If we assume that we will encounter "normal" temperature and rainfall conditions during growing season and if we have only 4 inches of stored soil moisture available at planting time, the model predicts yields increases of 35 to 60 bushels of corn per acre as the result of adding 4 more inches of water by irrigation during the growing season. If we make the same assumptions, the model predicts increases of 40 to 80 bushels per acre from adding 8 inches of water by irrigation when we have only 4 inches of stored soil moisture at planting time.

Cost of Irrigation. The best data we now have on the cost of irrigation come from the University of Nebraska. For 1976, the total cost of irrigating field corn with a center-pivot system was about $79 an acre per year. This includes capital equipment costs of $56 an acre per year and operating costs of $23 an acre per year. These figures do not include a cost for land or for other expenses not directly associated with irrigation. Nor do they include extra seed corn, extra fertilizer or other increased costs which may be associated with irrigation yield increases.

The total cost of producing corn in Nebraska under irrigation in 1976 was about $274 per acre. This figure included a cost of 6 percent for land evaluated at an average of $450 per acre. The breakeven corn price for irrigated corn production in 1976 under their costs was $2.19 per bushel for a yield of 125 bushels per acre, and $1.83 per bushel for a yield of 150 bushels per acre.

The cost of irrigating corn will probably be over $80 an acre per year for the 1978 season. In terms of the cost, irrigating vegetable crops in Illinois will not be appreciably different from irrigating corn. Thus, one can compute the yield increase that would be required to pay for the added costs of irrigation by dividing the figure of $80 per acre by the expected price per unit of the crop.

If the capital costs of an irrigation system run $400 per acre (including the well, power source, etc.) and land costs $2,000 per acre, the irrigation cost amounts to 16.7 percent of the total. If the land cost is $4,000 per acre, the irrigation cost become 9.1 percent of the total. Irrigating existing acreage now under will help stabilize production from year to year, and might also be considered in relation to purchasing or leasing additional land.

Other Considerations in Deciding to Irrigate. If a producer is convinced that it will be profitable for him to install an irrigation system, he must have an adequate source of water. Such sources do not exist at present in many parts of the state. We are fortunate in that underground water resources are generally good in the sandy areas where irrigation is most likely to be needed. Most of the irrigation development to date has taken place in these sandy regions.

A relatively shallow well in some of these areas may provide enough water to irrigate a quarter section of land. In some areas of Illinois, particularly the nothern third, deeper wells may provide a relatively adequate source of water for irrigation.

Many farmers are pumping their water streams for irrigation. This can be a relatively good and low-cost source; but, of course, the stream may dry up in a drought year.

Impounding surface water on an individual farm is possible in many areas of the state, and some farmers are doing that. However, an appreciable loss may occur both from evaporation and from seepage into the substrata. The rule-of-thumb figure is that you probably need to store 2 acre-inches of water for each acre-inch actually applied to the land. In many areas, the water development costs are likely to be beyond the range of feasibility of an individual farmer. However, such development by groups of farmers, cooperatives, or governmental agencies could produce a sufficient water supply in one containment for a number of irrigators.

At present, no permit is required in Illinois to use water for irrigation. The Riparian Doctrine governs the use of surface waters. Briefly, this states that a person is entitled to a reasonable use of the water which flows over or adjacent to his land, as long as he does not interfere with someone else's right to use the water. No problem results as long as there is plenty of water for everybody. However, when water becomes limiting, legal determinations may have to be made as to whether one's use to interferes with someone else's rights concerning the water. It may be important to have a legal record established in order to verify the date on which the use of water for irrigation began.

Now, assuming you believe it will be profitable for you to irrigate and that you have an assured supply of water, how do you find out what type of equipment is available and what will be best for your situation? University representatives have discussed this in various meetings around the state; but they cannot, of course, design a system for each individual farm. Your county Extension Adviser can provide you with a list of dealers located in Illinois and others who serve Illinois. This list gives the kinds of equipment each dealer sells, but will not give you information about the characteristics of those systems.

We suggest that you contact as many dealers as you wish and discuss your needs with them in relation to the type of equipment they sell. You will then be in a much better position to determine what equipment to purchase. To the best of our knowledge, there are no consulting irrigation engineers or agronomists in the state at present, independent of those staff members employed by irrigation manufacturers, dealers, or universities.

Management Requirements. Irrigation will provide maximum benefit only when it is an integral part of a high level management program. Good seed or plant starts of proper genetic origin planted at the proper time and at a sufficiently high plant population, accompanied by optimum fertilization, good weed control, and other recommended cultural practices, is necessary to assure maximum benefit from irrigation.

Farmers who invest in irrigation may become disappointed if they do not manage the irrigation properly. They often overextend their systems so much that they cannot maintain adequate soil moisture when the crop requires it.

For example, the system may be designed to apply 2 inches of water to 100 acres once a week. In 2 or more successive weeks, soil moisture may be limiting, with potential evapotranspiration equaling 2 inches per week. If the system is used on one 100-acre field one week and another field the next week, neither field may receive much benefit. This is especially true if moisture stress comes at a critical time. Inadequate production of marketable produce may result. Currently, we suggest that irrigators follow the practices they would use to obtain the most profitable yield in a year of ideal rainfall. In many parts of the state, 1975 was such a year. Other years have been nearly ideal in some sections of Illinois. If your yield is not already appreciably above your county average, you probably need to improve your management of other production factors before you invest in an irrigation system.

References (available by writing to Dr. M. D. Thorne, Extension Agronomist, S-212 Turner Hall, University of Illinois, Urbana, IL 61801).

Irrigation Mini-Guide for Illinois.
Irrigation - how much and how often (Univ. Minn. Ext. Folder 257).
List of irrigation dealers in Illinois.

ILLINOIS AGRICULTURAL PRODUCTS
"farm grown and Illinois good"

R. Kent Redfern

The Illinois Department of Agriculture encourages Illinois companies, commodity groups, and markets to use the IAP trademark on their product labels. To qualify, the product must be produced or processed in Illinois and be of above average quality. The quality standards are being developed by the standards committee composed of industry representatives.

The Illinois Agriculture Products trademark represents a marketing tool designed to promote and develop markets for Illinois agricultural products. The trademark is not simply a Department of Agriculture logo, it is for all of Illinois and it gives identity to this state's leading industry --- agriculture. The trademark can be used by all commodity groups, agri-businesses and organizations for promotions and consumer education programs. The trademark is registered with the federal government to insure that it will be used in an appropriate manner for Illinois agriculture and not in a derogatory manner.

The purposes of the trademark are: (1) To enable consumers to identify and select Illinois products when making a purchase; (2) To educate consumers and citizens of the importance of Illinois agriculture -- especially availability, quality, and diversity of its products; (3) To identify and promote Illinois agriculture in export markets.

Items available through the IAP program include product labels, bumper stickers, name tags, signs, shelf strips, tee-shirts, and helpful advertising facts and copy.

Watch for the trademark, talk about it, and buy Illinois Agriculture Products. As the slogan claims, they are "farm grown and Illinois good."

If you are interested in using the trademark in your business or organization, or want more information, please call or write the following: Telephone: (217) 782-6675, Illinois Department of Agriculture, Bureau of Marketing Development and Information, Emmerson Building, State Fairgrounds, Springfield, IL 62706.

Kent Redfern is Bureau Chief, Market Development and Information, Illinois Department of Agriculture, Springfield, Illinois.

DIRECT MARKETING PROGRAM FOR ILLINOIS

J. W. Courter

The University of Illinois Cooperative Extension Service and the Illinois Department of Agriculture have received federal funds ("Farmer-to-Consumer Direct Marketing Act of 1976") to improve the efficiency of farmer-to-consumer marketing. Program emphasis will be on farm-community markets and pick-your-own horticultural crops.

Objectives. The program will 1) survey the present status and direct marketing needs, 2) help communities and groups to organize, establish and operate community markets, 3) sponsor conferences and publish proceedings and guidelines to improve knowledge and skills in direct marketing, and 4) inform consumers of the opportunities and benefits of buying directly from farmers.

Conferences and meetings. The following meetings will present information on direct marketing. In addition many county-wide meetings are scheduled to teach gardeners improved cultural methods and varieties of small fruits and vegetables (contact your county extension adviser for dates and locations of local meetings).

January 23	Vegetable Growers School, Northeastern Illinois, St. Charles
January 24	Vegetable Growers School, Northeastern Illinois and Northwestern Indiana, Schereville, Indiana
January 27	Vegetable Growers School, Union County, Cobden
March 7	Small Fruits Seminar, Mt. Vernon
March 8	Illinois Strawberry School, Mt. Vernon
March 14	Roadside Market Conference, Collinsville
March 16	Vegetable Growers School, Jackson and Union Counties, Cobden
March 22	Community Market Conference, place to be announced (followed by Conferences in Central and Southern Illinois)
January,1979	National Pick-Your-Own Conference, to be announced

Publications Planned.

Directory, Illinois Farm-Community Markets
Directory, Illinois U-Pick Farms (These directories will be available from the Illinois Department of Agriculture, Bureau of Market Development and Information, Emmerson Building, Fairgrounds, Springfield, IL 62706).
Guidelines for Successful Community Markets
Proceedings, Illinois Strawberry School
Proceedings, Roadside Market Conference
Proceedings, Community Market Conference
Proceedings, National U-Pick Conference

Personnel involved in the program include Kent Redfern, Roberta Archer, and Larry Aldag, Division of Marketing and Agricultural Services, Illinois Department of Agriculture; J. W. Courter and J. S. Vandemark, Horticulture, C. C. Doll, Area Extension Adviser, and Daniel Padberg, Agricultural Economics, University of Illinois.

J. W. Courter is Extension Specialist, Small Fruit and Vegetable Crops.

ASSOCIATION OF CERTAIN INSECTS ON SQUASH, PUMPKIN, AND GOURDS IN ILLINOIS

A. M. Rhodes[1], *W. L. Howe*[2], *R. L. Metcalf*[3], *and P. Y. Lu*[3]

We have studied the attraction and behavior of several insect species that feed on squash, pumpkin, and wild gourds. These insect species include the southern corn root worm (also known as the spotted cucumber beetle), striped cucumber beetle, western corn root worm, northern corn root worm, squash bug, and squash vine borer.

From 1971 to 1974, we evaluated the Cucurbita host preference of 7 insect species. Preference and damage ratings for the four most destructive insects are recorded in Table 1. All four insect species were highly attracted to Cucurbita maxima, a cultivated species that includes cultivars of Banana, Hubbard, Turban, Buttercup and Mammoth. The species C. moschata, (cultivars Butternut and Dickinson Field), showed resistance to these insects. C. pepo, which includes Halloween pumpkins, Acorn squash, and the summer bush types, was susceptible to the squash vine borer. Cucurbita mixta (cultivars Green Striped Cushaw and White Cushaw) was highly attractive to the squash bug. The wild species C. lundelliana was highly attractive to the southern corn root worm.

The western corn root worm, a destructive pest in Illinois corn fields, has congregated in especially large numbers during the past 2 years in our experimental cucurbit plots. This beetle was observed in largest numbers on 2 wild species of gourds, C. lundelliana from Honduras and C. okeechobeensis from Florida. A preference test studied the behavior of the beetle on the 2 wild species of Cucurbita, C. mixta, C. moschata and corn silks. Fresh leaves of the 4 Cucurbita species were inserted in water-filled vials and taped to corn stalks in an infested field. Counts of the adult beetle made the following day showed that the numbers of adults feeding on the 2 wild species were at least 10 times greater than on the 2 cultivated species or corn silks (Table 2).

We can only hypothesize as to why the western corn root worm prefers to feed on these 2 wild Cucurbita gourds. Leaves of these species contain high concentrations of a bitter substance called cucurbitacin. The ingestion of the bitter substance may relate to a defense mechanism evolved for protection against birds or other insect-feeding vertebrates. Once the insect begins to feed on the plant, they apparently emit an "odor" (aggregation pheromone) that attracts large numbers of other western corn root worms to the feeding site. The identification of such a pheromone and its successful synthesis could conceivably provide an effective tool to trap the insect before it could damage corn or other susceptible cultivated crop

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n a third study, systematic counting of cucumber and corn root worm beetles in ucurbita blossoms was conducted from June to October, 1977. The averaged peak alues of these insects from 10 blossoms are summarized in Table 3. The data learly suggest that the striped cucumber beetle was dominant in June, although the opulation was not high, followed by western corn root worms, and finally by outhern corn root worms. The population of northern corn root worms was low.

TABLE 1. INSECT ASSOCIATION WITH CUCURBITA. DATA MAXIMUMS CONVERTED TO 10 BASE FOR INDIVIDUAL INSECT FACTORS

	Cultivated species				Wild species
nsect	maxima	moschata	pepo	mixta	lundelliana
o. corn root worm					
Adults, early	7.4	2.6	3.3	1.1	10.0
Adults, late	8.3	2.8	3.1	3.6	10.0
triped cucumber beetle					
Adults, early	10.0	2.0	4.7	3.9	3.1
Damage, late	10.0	3.5	5.1	5.5	4.3
quash bug					
eggs	8.5	0.5	2.1	10.0	2.6
quash vine borer					
damage	10.0	0.9	9.2	0.8	2.2

TABLE 2. ADULT WESTERN CORN ROOT WORM ATTRACTION TO HIGH AND LOW CUCURBITACIN FOLIAGE FROM WILD AND CULTIVATED SPECIES OF CUCURBITA AND CORN SILKS

Cucurbita species	Source	No. adults[1] attracted	Foliage cucurbitacin
lundelliana	Hondura	30.8	high
okeechobeensis	Florida	29.8	high
mixta	Green Striped Cushaw	2.8	low
moschata	Butternut	0.8	low
corn silks	-----	0.9	--

[1] *Insect counts 24 hours after exposure*

TABLE 3. AVERAGE PEAK VALUES OF CUCUMBER AND CORN ROOT WORM BEETLES IN CUCURBITA BLOSSOMS[1]

Cucurbita species	Striped cucumber beetles	Western corn root worm	Southern corn root worm
maxima	3.4 (6-23)[2]	27.4 (8-3)	22.5 (9-23)
moschata	3.6 (7-22)	27.9 (8-1)	8.2 (9-27)
pepo	2.5 (7-12)	31.0 (7-27)	13.0 (9-7)
mixta	6.0 (6-29)	12.2 (8-1)	6.6 (8-25)
lundelliana	0.5 (8-1)	11.0 (8-1)	13.8 (9-5)

[1] Northern corn root worm was 1.1 (8-11) for C. pepo and 0.0 for others
[2] Date of observation

A COMPARISON OF MUSHROOM COMPOST, SEWAGE SLUDGE, COMMERCIAL FERTILIZER AND NO FERTILIZER UPON THE YIELD OF VEGETABLE CROPS

Ismail B. Hashim, Joseph S. Vandemark and Walter E. Splittstoesser

Introduction

In recent years more homeowners are growing vegetable gardens. These homeowners either fertilize their gardens with a commercial fertilizer or an "organic" fertilizer or use none. Studies were conducted to evaluate the influence of commercial fertilizer, mushroom compost and sewage sludge on vegetable crop production.

Materials and Methods

The study was located at the Illinois River Sand Field at Kilbourne on Plainfield Sand which has extremely low exchange capacity, 0.6-0.8% organic matter, water soluble phosphorus of 100 lb/A and a potash level of 150 lb/A. Applications of 12-12-12 commercial fertilizer, mushroom compost, and sewage sludge (Nu-Earth) were applied at sufficient rates to make the nitrogen levels of the plots approximately equal and about equal to an application of 120 lbs of nitrogen per acre (Table 1). All plots were tilled to incorporate the material into the top 4-6 inches of soil.

Table 1. Fertilizer Analysis.

Fertilizer	Analysis ($N-P_2O_5-K_2O$)	lbs. nitrogen applied/acre
None	0-0-0	0
Mushroom compost	0.7-0.6-2	112
Sewage Sludge (Nu Earth)	1-1-0.1	120
Chemical Fertilizer	12-12-12	120

The crops used in this study were: 'Vates' kale, 'Vates' collards, 'Market Prize' cabbage, 'Green Wave' mustard, 'Large White Rib' and Lucullus' swiss chard, 'Tenderette' snap beans, 'Moon Gold' wax beans, 'Roma' broad beans, 'Sundance' sweet corn, 'Emerald' okra, 'Lady Belle' peppers, 'Dickinson Field' pumpkin, 'Table Queen' winter squash, 'C-28' and 'Jet Star' tomatoes, 'Ruby Queen' beets, 'Spartan Bonus' carrots and 'Kenebec' potatoes. Cabbage, peppers and tomatoes

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were transplanted; other crops were direct-seeded.

Each plot consisted of 20 feet of each vegetable at each fertility level, with the middle ten feet of row being sampled. Spacing was similar to that used commercially. The plots were weeded mechanically and insects and diseases were controlled with approved chemicals.

Tomato fruits were harvested at three dates and total yields reported. The other crops were harvested once when they would normally be harvested for optimum qualit The fresh weight of only the edible plant part is reported.

Results and Discussion

Different vegetable crops require different amounts of nitrogen, phosphorus and potassium. Vegetables grown without any fertilizer often showed nutrient deficiency symptoms and yields were always lower than similar plants receiving some fertilizer, compost, or sludge (Table 2). Many vegetables grown with mushroom compost or sewage sludge received adequate amounts of nitrogen and phosphorus but were deficient in potassium. Crops such as kale, beans, sweet corn, winter squas 'Jet Star' tomatoes and carrots produced equally well when grown on compost or sludge. Others such as cabbage, pumpkin and potatoes, produced more when grown with sewage sludge than with mushroom compost. In general, vegetables grown with a complete, balanced chemical fertilizer produced the highest yields. The total yield was 323% greater than vegetables grown with no fertilizer, 104% more than vegetables grown with mushroom compost and 37% more than those grown with sewage sludge (Table 2).

Sewage sludge varies greatly in composition. Raw sewage should not be applied to the garden soil as these sludges may carry human diseases which are absorbed b the plant and found in the edible part. Heat treated sludges are normally safe from a sanitary viewpoint. Another potential hazard is the toxicity from heavy metals such as cadmium. Sludges from industrial areas generally contain some heavy metals and it is not possible to use these as a fertilizer without adding toxic elements to the garden soil. Leafy and root vegetables are effective in accumulating a toxic element like cadmium. If the cadmium levels are less than 50 ppm, the application of sludge should not exceed 250 lbs per 1000 sq. ft. Sludges that exceed 50 ppm cadmium probably should not be used on vegetable gardens. Most sludges may be used on lawns, flowers, shrubs and trees.

Table 2. Yield of vegetables grown at various fertility levels.

Vegetable	Number of Plants	Fertilizer: None	Mushroom Compost	Sewage Sludge	Chemical Fertilizer
		Yield (lbs)[1]			
Leafy					
Kale	30	0.9	6.2	6.7	11.7
Collards	30	1.7	10.3	8.3	17.3
Cabbage	10	6.0	20.5	28.2	28.3
Mustard	30	1.8	12.3	8.5	8.4
Swiss Chard					
Large white rib	40	0.6	4.9	1.5	1.4
Lucullus	40	1.2	8.7	6.5	3.7
Fruits					
Beans					
Snap	50	1.4	2.8	3.6	3.8
Wax	50	1.6	3.3	3.6	3.7
Broad	50	1.4	3.8	3.6	4.1
Corn, Sweet	12	13.3	18.6	18.4	26.6
Okra	10	1.1	1.5	2.1	2.5
Peppers	6	4.5	7.8	6.0	6.4
Pumpkin	10	86.0	242.0	345.0	436.0
Squash, winter	10	18.0	60.0	59.0	60.0
Tomato					
C-28	10	34.9	47.1	66.1	83.8
Jet Star	10	35.9	99.5	98.8	99.9
Watermelon	10	190.0	150.0	255.0	250.0
Roots and Tubers					
Beets	50	0.4	8.3	6.8	9.8
Carrots	50	0.4	1.2	1.3	0.9
Potato	10	14.7	26.5	30.0	27.0
Total Yield	--	335.8	735.3	959.0	1084.7
% increase over none		--	219.0	286.0	323.0

[1] Tomatoes were harvested 3 times, other vegetables once.

A STUDY OF A NEW GROWTH REGULATOR ON THE SUGAR CONTENT OF CARROT AND BEET ROOTS

James M. Pisarczyk, Walter E. Splittstoesser and Joseph S. Vandemark

Carrot (Daucus carota var. sativa L.) and beet (Beta vulgaris L.) roots are usually harvested while the leaves are alive, and these leaves are then discarded. The leaves contain considerable carbohydrate and if this sugar could be mobilized and translocated to the roots, it would increase the sugar content of the harvested product. We applied 2,3 dihydro-4-6-diphenyl-1,4 oxathiin (UNI-P293) at various rates to carrots and beets 3 weeks before harvest in an attempt to increase the sugar content of the roots.

'Minicube' and 'Spartan Bonus' carrots and 'Detroit Dark Red' beets were grown in a complete randomized block with 4 replications. UNI-P293 was applied with a CO_2 gas sprayer in 934 liters of water per hectare. After 3 weeks, 10 feet of row was harvested and one gram samples were removed from the roots with a cork borer. These samples were extracted with ethanol:water (80:20 v/v) and the soluble sugar content determined with anthrone with D-glucose as the standard.

UNI-P293 induced a significant increase in sugar content of 'minicube' carrots but not in 'Spartan Bonus'. (Table 1).

Table 1. Effect of UNI-P293 on sugar content of carrot and beet roots.

Rate	Carrot		Beet
(kg/ha)	Minicube	Spartan Bonus	Detroit Dark Red
		(% sugar content)[z]	
0	7.0 a	5.9 a	12.3 a
1.5	7.5 b	--	12.7 a
3.0	8.3 c	6.0 a	12.7 a
4.5	--	5.4 a	--

[z]Any two comparable means not followed by the same letter are significantly different at the 5% level according to Duncan's multiple range test.

UNI-P293 had no effect upon the sugar content of beet roots. Although a significant increase in sugar content of 'minicube' carrot roots occurred, it is doubtful that this 1.3% increase is sufficient to justify a 3 kg/ha rate of UNI-P293. As 'Spartan Bonus' did not show a response, it is obvious that varietal differences also occur.

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A STUDY OF GROWTH REGULATORS ON FIELD GROWN SNAP BEANS IN RELATION TO YIELD

James M. Pisarczyk, Walter E. Splittstoesser and Joseph S. Vandemark

ABSTRACT

SADH (succinic acid-2,2 dimethylhydrazide) and UNI-P293 (2,3 dihydro-5-6-diphenyl-1,4 oxathiin) were applied to White Half-runner, Tendercrop, and Resistant Cherokee Wax snap beans (Phaseolus vulgaris L.) at several rates in an attempt to retard growth and increase yield. No treatment increased yield, and some reduced yield compared to the untreated plots. The treatments affected transpiration of Tendercrop only and had no effect on water potential (drought resistance).

INTRODUCTION

Growth retardants have been used on snap beans in an attempt to increase yield. When 5-Chloro, 2-thenyl, tri-n-butyl phosphonium chloride (CTBP) was applied to several cultivars of snap beans at first flower, three cultivars produced significant increases in yield while other cultivars did not. The application of 5-Bromo, 2-thenyl, tributyl-ammonium chloride (CHE9064) to spring-grown 'Salem' and 'Top Crop' snap beans at first flower, resulted in a significantly greater yield; and this increase in 'Top Crop' was a result of increased pod set.

Growth retardants have been reported to affect the drought tolerance of plants. When water was withheld from container-grown bean plants, the untreated plants wilted faster and more severely than those treated with Phosfon-D or CCC. CCC applied as a soil drench decreased the transpiration rate of beans grown at several soil moisture levels.

In our experiments, SADH and UNI-P293 were used to decrease the vegetative growth of snap beans and to increase pod set, resulting in increased yield. Transpiration and water potentials were measured to determine if either were affected by the treatments.

MATERIALS AND METHODS

Spring plantings of White Half-Runner and Tendercrop snap beans were planted in May. Plants were sprayed at either first blossom (Early) or six days later (Late) when bean pods were 1 1/2" long. SADH was applied at rates of 4 and 8 kg/ha (a.i.) and UNI-P293 at rates of 1.5 and 3 kg/ha. The experimental design for each variety was a 3 factor factorial in a randomized complete block of 2 chemicals x 3 rates of application x 2 dates of application, with three

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replications. Ten feet of row were completely harvested in each experimental unit in July. Chemicals were applied with a CO_2 gas sprayer in 934 liters of water per hectare.

Summer plantings of White Half-Runner and Resistant Cherokee Wax were planted in July and treatments similar to those of the spring planted snap beans were applied. The experimental design was a completely randomized design with 5 treatments and 5 replicates. The snap beans were completely harvested in September.

Water potential was measured with a Scholander pressure chamber and transpiration was measured with a diffusion resistance porometer on the fifth trifoliate leaf. The diffusive resistance of the upper and lower leaf surfaces was measured, and the total resistance was calculated by assuming that the upper and lower leaf surfaces were resistances in parallel.

RESULTS

There was no visible damage to snap beans at either rate of SADH. UNI-P293 treated bean plants developed a marginal chlorosis of the upper leaves and newly formed leaves were cupped in appearance.

In the spring plantings, bean yields were significantly reduced by treatment with growth retardants. (Table 1). The beans sprayed when pin beans were 1 1/2" long had a higher yield than those sprayed at first blossom.

Table 1. Effect of growth retardants on bean yield.

Date	White Half-Runner (kg/ha)	Tendercrop (kg/ha)
Early	2088	3636
Late	2873	5319

The growth retardants significantly reduced the yield of Tendercrop and increasing rates produced decreasing yields. (Table 2).

Table 2. Effects of growth retardants on Tendercrop yield.

Rate	Yield (kg/ha)
0	6105
Low	4579
High	3434

Water potential of Tendercrop was affected by treatment, with UNI-P293 treated beans having a more negative water potential than the SADH treated beans. Transpiration was significantly reduced by the growth retardants and beans treated at the high rates had the highest resistance to transpiration (Table 3).

Table 3. Effects of growth retardants on water potential and transpiration of Tendercrop.

Chemical	Water Potential (Bars)	Rate	Resistance (sec/cm)
UNI-P293	-8.02	0	2.13
SADH	-6.76	Low	2.20
		High	2.72

The yield of summer plantings of Resistant Cherokee Wax beans was significantly decreased when treated at the pin beans stage with both the low and high rates of UNI-P293. (Table 4)

Table 4. Effects of UNI-P293 on Resistant Cherokee Wax.

Rate (kg/ha)	Date	Yield (kg/ha)
0	----	7991 A
1.5	Early	6285 A
1.5	Late	5791 B
3.0	Early	6465 A
3.0	Late	4489 B
		LSD α = .05

No treatment (Early or Late) of UNI-P293 increased yield of Resistant Cherokee Wax but UNI-P293 produced no significant effect on yield or water potential of White Half-Runner. (Table 5)

Table 5. Effect of UNI-P293 on White Half-Runner.

Rate (kg/ha)	Date	Yield (kg/ha)	Water Potential (bars)
0	----	5073	-5.80
1.5	Early	5926	-6.94
1.5	Late	5499	-5.62
3.0	Early	6061	-6.58
3.0	Late	3479	-5.99

When Resistant Cherokee Wax beans were treated with SADH at first blossom, yields were significantly decreased, but late applications had no effect on yield. No treatment significantly increased yield. Water potential of Resistant Cherokee Wax was not significantly affected by treatment with SADH. (Table 6)

Table 6. Effect of SADH on Resistant Cherokee Wax.

Rate (kg/ha)	Date	Yield (kg/ha)	Water Potential (bars)
0	----	7407 A	-6.90
4.0	Early	5724 B	-6.88
4.0	Late	7565 A	-6.72
8.0	Early	5297 B	-6.23
8.0	Late	6689 A	-6.48
		LSD α = .05	

When White Half-Runner beans were sprayed with SADH, the high rate of SADH significantly decreased yield. No SADH treatment significantly increased yield. Water potential of White Half-Runner was not significantly affected by SADH treatment. (Table 7)

Table 7. Effect of SADH on White Half-Runner.

Rate (kg/ha)	Date	Yield (kg/ha)	Water Potential (bars)
0	----	7497 A	-7.33
4.0	Early	5791 A	-6.23
4.0	Late	5634 A	-6.77
8.0	Early	4511 B	-6.28
8.0	Late	4242 B	-6.07
		LSD α = 0.05	

DISCUSSION

Although there have been reports of growth retardants increasing the yield of snap beans, neither SADH nor UNI-P293 treatments significantly increased yield of any variety in these experiments. Several treatments significantly decreased yield and this has been reported before. Water potential was not significantly affected in the field by treatments of either SADH or UNI-P293. The water potential values show that the beans were not severely stressed during the period when water potential was measured. Transpiration of white Half-Runner beans was not significantly affected by treatment with growth retardants. However, a small but significant decrease in transpiration of Tendercrop occurred at the high rates of application of SADH and UNI-P293. With the varieties and application rates used in these experiments, it can be concluded that SADH and UNI-P293 cannot be used to produce increased yields of snap beans.

THE GROWTH OF VEGETABLE TRANSPLANTS IN PLASTIC, CLAY AND PEAT POTS

Joseph S. Vandemark and Walter E. Splittstoesser

Introduction

Vegetable transplants grown for homeowners are produced in various types of containers and the container size affects the size of the vegetable at transplanting time. This past year, different vegetables were grown in different types and sized pots to determine their influence on the vegetable plants at transplanting time.

Materials and Methods

Tomato (Jet Star and C-28), cabbage (Market Prize) and pepper (Sweet Banana) seeds were planted into clay and plastic pots with 4 inch diameters and peat, clay and plastic pots of 2.5 inch cm diameters. The pots were arranged to allow each plant the same amount of growing space (36 sq. inches). Six replications were randomized and grown in early spring, in the greenhouse. The vegetable plants were grown for 6 weeks, at which time they normally would have been transplanted into the garden. The plant height was measured, the plant cut off at ground level, and the weight determined.

Results and Discussion

Vegetables grown in 4 inch pots were taller and weighed more than those grown in 2.5 inch pots (Table 1). The smaller size of the plants grown in 2.5 inch pots was due to the limited amounts of nutrients and soil volume available for root growth. The roots were potbound within the 6-week period. All plants received equal amounts of sunlight, water, and growing area for the tops. Vegetable plants grown in 2.5 inch pots had less weight per unit length, indicating that these plants were elongated and less compact than plants grown in 4 inch pots.

Vegetable plants grown in 2.5 inch peat pots weighed significantly less at transplanting time than those grown in either plastic or clay pots (Table 1). In addition, tomato plants were taller, indicating that they were spindly plants. Peat pots lose water rapidly, resulting in the necessity of more frequent watering. Each morning all plant containers were watered to field capacity, and plants grown in peat pots appeared deficient in water by the end of the day. Watering regimes should also be different for clay and plastic pots. Clay pots are porous and have water loss through the sides of the pot, while plastic pots are not porous. Plants grown in clay pots will need more frequent watering.

The growth of vegetable plants in clay and plastic pots depended upon the pot size and the plant being grown. Tomato plants grew better in 2.5 inch clay pots than

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Table 1. Growth of vegetable transplants in various containers.

Container	Tomato				Pepper		Cabbage	
	Jet Star		C-28		Sweet Banana		Market Prize	
	height	weight	height	weight	height	weight	height	weight
2.5 inch	(inches)	(g)	(inches)	(g)	(inches)	(g)	(inches)	(g)
Peat	12.6	26	8.3	20	7.9	9	2.4	24
Plastic	11.8	29	7.1	22	11.0	14	2.4	27
Clay	11.4	34	7.1	27	9.1	14	2.4	27
4 inch								
Plastic	17.3	53	11.0	42	11.8	21	3.5	53
Clay	15.0	45	10.2	40	12.2	23	3.5	62

1 g(gram) equals 0.035 ounces

plastic ones. Plants weighed more and were more compact. However, in 4 inch pots, tomato plants produced the same weight per unit length in both clay and plastic pots, but grew significantly larger in plastic pots.

Pepper plants produced the same weight in both 2.5 inch clay and plastic pots but were more compact in clay pots. There was no significant difference in pepper plants grown in 4 inch clay or plastic pots.

Cabbage plants grew equally well in 2.5 inch clay or plastic pots, but 4 inch clay pots produced better and larger cabbage plants than plants grown in similar plastic pots.

Conclusions

If 2.5 inch pots are to be used, tomatoes and peppers should be planted in clay pots, while cabbage plants grow equally well in either clay or plastic pots. For best plant production and plant development, it is recommended that homeowners grow their transplants in 4 inch containers. In 4 inch containers, cabbage plants grew best in clay pots; pepper plants grew equally well in clay or plastic pots; and tomato plants grew best in plastic pots.

Purslane Sawfly Helps Control Common Purslane

F. GORSKE, H. J, HOPEN, and R. RANDELL

Now CONSIDERED an objectionable weed, purslane (*Portulaca olercea*) was once cultivated for food. is such, it was an early immigrant to merica, arriving from either Europe r Asia about 300 years ago. Accordig to reports dating from the late eventeenth century, it was being culvated at that time in Massachusetts.

Because purslane is so prolific, it pread rapidly through the country, iriving on rich, moist soils. It has ow become a major pest in vegeible fields, orchards, ornamental urseries, and now even some soyean and grain fields, where it cometes for water, nutrients, and, to a sser degree, light and space.

Purslane is difficult to control. It ften escapes herbicide treatment beause it doesn't germinate until soil nd air temperatures are high, and y that time herbicides may be dissiated. Cultural practices may be ineffective because an uprooted pursne plant can send out adventitious ots and re-establish itself without iffering much damage.

Fortunately, another immigrant to merica can control common pursne at least partially and sometimes ompletely. This immigrant is the urslane sawfly (*Schizocerella piliornis*). We don't know just when was introduced to this country, but probably arrived at some time with purslane plant.

The purslane sawfly was first udied in 1898, when it was generly distributed over Ohio and probly other states. Currently it can be und from Florida to Texas and orth to Montana and Minnesota. It has also been identified in Mexico. Argentina, Bolivia, Uruguay, Venezuela, and Jamaica, and now occurs in Australia, where it was accidentally introduced from the United States.

In central Illinois the adult purslane sawfly can be seen flying around purslane plants from May to September. The male adult can be identified by his forked antennae; the female's antennae are not forked.

The adult male purslane sawfly (right) can be distinguished from the female by its forked antennae.

Life cycle

Before ovipositing, the female examines the purslane leaves and selects the healthiest ones. She lays her eggs in the edges of the leaves, being cautious to lay only one egg per leaf. As the egg develops, it resembles a small blister. Larvae hatch from the eggs after about 80 hours.

There are two types of larvae: One is a leaf miner which will mine out the leaf, leaving only the cuticle intact. After devouring one leaf, it emerges, crawls over to another, and begins its mining all over again. The second type of larva feeds only from the outside of the leaf. It will eat about twice as much as the leaf miner.

The two types of larvae are identical in appearance except that the externally feeding larva is bigger. However, there are large genetic differences between the two types, according to electrophoretic experiments on four enzyme loci.

The larval stage lasts about 130 hours, after which the larvae crawl down the plant to the ground, where they tunnel into the soil to a depth of 2.5 to 5.0 centimeters (1 to 2 inches). There the larvae spin silken cocoons, to which tiny bits of soil and sand adhere. About 200 hours later the adults emerge, mating occurs, and the female begins to lay eggs. The adults live only about 24 hours and do not feed; egg laying is

Larva feeding on the outside of a purslane leaf.

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their sole purpose. In central Illinois the sawfly undergoes six to seven generations in a single season.

The sawflies overwinter as pupae in the soil at the base of purslane plants. Fall and spring plowing destroys a high percentage of these overwintering larvae. The survivors are mostly those that overwinter in the aisle ways and fencerows. As a result, the population is slow to build up in the spring and the first and second generations are very small. Late in the third generation some control of purslane is noticeable, and by the fourth generation, most of the purslane is stripped of its leaves.

Feeding and pesticide tests

The purslane sawfly is a very specific feeding insect. In starvation tests, it fed on only two plant species. These were *Portulaca oleracea* (common purslane), the major host plant in the Midwest; and *Montia perfoliata* (miner's lettuce), which is a close relative of *P. oleracea*.

Included in these tests were major representatives of the *Portulacaceae* family (Table 1). Sixteen other plants were also tested for larval feeding, including the major broadleaf and grassy weeds of central Illinois and several economic plants that are usually grown where purslane is found. The larvae did not feed on any of these plants, and consequently died. The 16 plants were:

- Red root or rough pigweed (*Amaranthus retroflexus*)
- Velvet leaf (*Abutilon theophrasti*)
- Jimson weed (*Datura stramonium*)
- Cocklebur (*Xanthium pennsylvanicum*)
- Ivy-leaved morning glory (*Ipomoea hederacea*)
- Common ragweed (*Ambrosia artemisiifolia*)
- Prickly sida (*Sida spinosa*)
- Prostrate spurge (*Euphorbia supina*)
- Carpetweed (*Mollugo verticillata*)
- Pennsylvania smartweed (*Polygonum pennsylvanicum*)
- Lambsquarter (*Chenopodium album*)
- Yellow foxtail (*Setaria lutescens*)
- Tomato (*Lycopersicum esculentum*)
- Cotton (*Gossypium neglectum*)
- Peas (*Pisum sativum*)
- Lettuce (*Lactuca sativa*)

Table 1. — Effects of Purslane Sawfly Larvae on Plants From Portulacaceae Famil

Plant	Effect of larvae
Portulaca oleracea (common purslane)	Egg laying and complete defoliation
Stems only	Some feeding but not enough to support lif
Portulaca grandiflora (moss rose)	Some minor cuticle scratching
Portulaca pilosa	No feeding
Portulaca spp. unknown	No feeding
Montia perfoliata (miner's lettuce)	Egg laying and complete defoliation
Talinum paniculatum	No feeding
Trianthema portulacastrum (horse purslane)	No feeding

Pesticides that are commonly used in areas inhabited by the purslane sawfly were screened for larval tolerance. Even at very low rates, the insecticides in the test completely killed the sawfly larvae (Table 2). When applied directly to the larvae and their food supply, herbicides were also lethal. However, when applied to the soil during the pupal stage, they did not cause death. Of the two fungicides tested, maneb was the only one that caused any mortality, and then it affected only a small percentage of the population.

These results indicate that extreme care must be taken in applying pesticides to avoid harming the purslane sawfly population.

A deadly microsporidian

The purslane sawfly is extremely susceptible to infection by a particular microsporidian, which is a type of parasitic organism. Spores of the microsporidian enter the host through its digestive tract as it feeds. The microsporidian can also be transmitted to progeny of an infected female via the egg.

Typically the purslane sawfly microsporidian infects the midgut, fat bodies, gonads, and eventually the muscle tissue. The cytoplasm of infected fat bodies is filled with spores which defract light, giving the larvae a whitish appearance instead of their normal green color.

By acting as a natural check on the sawfly population, the microsporidian can actually benefit the sawfly. Without any population controls, there would be a tremendous increase in the number of sawfly larvae by late July, with a consequent increase in demand for food. Soon the purslane plants would be stripped of their

Table 2. — Percent Mortality 48 Hour After Pesticide Applications to Larvae on Foliage

Pesticide	Rate of application: 10% of normal	Normal	10 X normal
	Pct. destruction		
Insecticides			
Carbaryl	100	100	100
Malathion	100	100	100
Biological agent			
Bacillus thuringiensis	20	50	100
Herbicides			
DCPA	0	100	100
Nitrofen	0	100	100
Trifluralin	10	75	100
Fungicides			
Chlorothalonil	0	0	100
Maneb	0	10	95
Control			
Water	0	0	0

leaves and succeeding generations o the sawfly would starve to death.

A useful weapon

Weed control by the use of insect has been most successful in range lands or other uncultivated areas Since common purslane grows in intensively cultivated areas, it does no fit into the pattern of usual biological control. However, the purslane sawfly does have the potential o partially controlling purslane in cultivated areas and completely controlling it in areas that are not heavily cultivated and do not receive heavy pesticide applications. Once the sawfly has stripped the purslane of it leaves, regrowth is very slow, with the new leaves being continually fe upon.

If managed properly, the purslane sawfly can be a valuable weapon i the battle against purslane.

VEGETABLE VARIETIES FOR COMMERCIAL MARKET GROWERS

J. S. Vandemark and J. W. Courter

'arieties of vegetables are listed below as a guideline to help market growers ,elect new and improved varieties. The newest varieties that show promise for llinois are suggested (trial). Try them along with some of the ones that appear romising in current catalogs and trade publications. Individual market prefer- nces, season of maturity, methods of culture, and varietal adaptation to soil and limatic factors will influence performance and the ultimate selections.

dditional information on varieties for these and other vegetables is in 'Vegetable Gardening for Illinois", Circular 1150. This book is available at ost of $2.00 from Office of Publications, 123 Mumford Hall, University of llinois, Urbana, IL 61801. Make checks payable to the University of Illinois.

SPARAGUS

alifornia Number Series (trial)
F_1 Hybrids (trial)
lartha Washington
lary Washington

BEANS-SNAP

(green)

stro
Blue Crop
Bush Blue Lake
ascade
ontender
reensleeves
larvester
rovider
Slim Green
Spartan Arrow
Sprite
endercrop
Tenderette
endergreen
Tenderwhite

(yellow)

Gold Crop
Midas
Moongold
Resistant Cherokee
Resistant Kinghorn
Sungold

BEANS-LIMA

Allgreen
Fordhook 242
Thaxter
Thorogreen

BEETS

Detroit Short Top
Explorer
Garnet
Gladiator
Mono-King
Perfected Detroit
Red Ball
Red King
Royal Red
Ruby Queen

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BROCCOLI

Green Comet
Green Duke (trial)
Premium Crop

BRUSSELS SPROUTS

Jade Cross Hybrid

CABBAGE

YR = yellows resistant
BRR = black rot resistant

(early)

Emerald Cross
Jet Pak
Market Dawn
Resistant Golden Acre
Stonehead

(main crop)

Danish Ballhead
Defender YR, BRR
Green Boy
Greenback YR
Guardian YR, BRR
King Cole YR
Market Prize
Market Topper
Resistant Danish
Rio Verde
Superette YR (trial)

(special)

Savoy
 Savoy Ace
 Savoy King
Red
 Red Acre YR
 Red Ball
 Red Danish
 Red Head

CARROTS

Gold King
Gold Pak
Hi-Pak
Nantes
Pioneer
Spartan Fancy
Tuchon
Tendersweet
Trophy
Waltham Hi-Color

CAULIFLOWER

Self Blanche
Snow Crown
Snow King
Snowball Strains

CHARD

Burgundy (red)
Lucullus (white)

COLLARDS

Georgia
Vates

CUCUMBERS

Burpee Hybrid
Challenger
Gemini
Poinsett
Saticoy
Triumph
Marketmore
Slicemaster (trial)
Victory (trial)

(pickles)

Liberty (trial)
Peppi
Pioneer
Salty
Spartan Dawn
WIS SMR 18

(greenhouse)
La Reine

EGGPLANT *(Large Oval)*

Black Beauty
Black Magic Hybrid
Burpee Hybrid
Classic
Dusky (trial)
Jersey King (trial)

KALE

Dwarf Blue Curled Scotch
Dwarf Curled
Dwarf Siberian

LETTUCE

(greenhouse)

Bibb
Grand Rapids (tip burn resistant strains)

MUSKMELON

Burpee Hybrid
Early Crenshaw (trial)
Gold Star Hybrid
Harper Hybrid
Harvest Queen
Saticoy Hybrid
Supermarket Hybrid

MUSTARD

Green Wave
Southern Giant Curled

OKRA

Clemson Spineless
Dwarf Green Long Pod
Emerald

ONIONS *(yellow)*

Abundance
Autumn Spice
Autumn Splendor
Bounty
Fiesta
Golden Globe

ONIONS *(yellow) continued*

Nutmeg
Ringmaster
Topaz
Yellow Globe

(red)

Benny's Red
Ruby

(transplants)

Benny's Red (trial)
Sweet Spanish types (yellow and white)
Ruby (trial)

(green bunching)

Beltsville Bunching
Evergreen Long White
Southport
White Lisbon

PEPPERS

(bell type)

Bellringer
Better Bell (trial)
California Wonder
Early Prolific (trial)
Early Set (trial)
Florida VR-2 (trial)
Keystone Resistant Giant
Lady Bell
Tasty
Yolo Wonder

(special)

Cubanelle
Hungarian Wax
Jalapeno
Sweet Banana

POTATOES

(early)

Cobbler
Norchip
Norland
Superior

(late)

Kennebec
Red La Sota
Red Pontiac

PUMPKINS

(small)

Small Sugar
Spookie
Sugar Pie

(intermediate)

Funny Face
Spirit
Young's Beauty

(large)

Big Tom
Conn Field
Halloween
Howden Field
Jackpot

SPINACH

(spring)

LS Bloomsdale
Melody (trial)

(fall)

Early Hybrid 7
Melody (trial)
Old Dominion
Savoy Hybrid

SQUASH

(summer)

Yellow
- Early Prolific Straightneck
- Golden Girl
- Golden Zucchini (trial)
- Seneca Butterbar Hybrid
- Seneca Prolific

Green
- Zucchini
- Zucchini Hybrids

(winter)

Acorn
- Ebony
- Table Ace (semi-vining)
- Table King (bush)
- Table Queen

Butternut
- Hercules (large)
- Hybrid Butternut
- Ponca (small, trial)
- Regular
- Waltham

Buttercup
Delicious
- Golden
- Green

Hubbard
- Blue
- Golden
- Green
- Improved
- Warted

Kinred
NK 530
NK 580

SWEET CORN

(early)

Aztec
Earlibelle
Earliking
Northern Belle
Spring Gold
Sundance

SWEET CORN *continued*

(main crop)

Bellringer (trial)
Bonanza (trial)
Cherokee (trial)
Gold Cup
Golden Gleam (trial)
NK 199
Reliance (trial)
Seneca Chief
Style Pak
Sweet Sue (bicolor)

(late)

Biqueen (bicolor)
Country Gentlemen
Gold Queen
Silver Queen

(high sugar)

Candy Bar (trial)
Candyman (trial)
Early Xtra Sweet (trial)
Honeycomb (trial)
Illini Xtra Sweet (trial
Sugar Loaf (trial)

SWEET POTATOES

Centennial
Jasper
Nugget

TOMATOES

(early)

Campbell 1327
Heinz 1350
Heinz 1439
Spring Giant
Springset (north)
Starfire (north)

(main crop and late)

Better Boy
Big Girl (trial)
Bragger (trial)
Burpee VF
Jet Star
Pink Wrap (pink)
Red Pak
Show-me (trial)
Sunripe (trial)
Super Fantastic
Supersonic
Traveler (pink)
Wonder Boy

(yellow, orange)

Golden Boy
Jubilee
Sunray

(greenhouse)

Michigan-Ohio Hybrid
Ohio MR-13
Ohio WR-25

TURNIPS

Just Right Hybrid
Purple Top White Globe

WATERMELONS

(seeded)

Charleston Gray
Crimson Sweet
Iopride (trial)
Jubilee
Sweet Favorite (trial)
Sweet Princess
Yellow Baby, early, yellow flesh (trial)

(seedless)

Tri X 313
Triple Sweet

POLLINATION OF FRESH VEGETABLE AND CANNING CROPS

Elbert R. Jaycox

Vegetable growers interested in producing heavy yields of good quality crops must consider the pollination requirements of the plants they grow. Pollination is a critical event in crop production, because it is one of the first steps in making the fruit and seed of a plant. The pollen grains, which are the male cells, are transferred to the receptive surface or stigma of the female organ of the flower. After that, fertilization takes place; then the seed and fruit begin to develop. Different crop species have different pollination methods and requirements. In some crop plants, the male and female parts are close together in each flower and the pollen is released automatically onto the stigma; snap bean and pea flowers are of this type. In other plants, pollination may occur within the flowers when they are moved by the wind or by insects; the tomato flower is an example. When grown in the greenhouse, tomato plants must be vibrated mechanically or visited by bees in order to set fruit.

Some crop plants produce separate male and female flowers on the same plant or on different plants. Such an arrangement requires the transfer of pollen from one flower to another or between different plants. In sweet corn, wind and gravity move the dry pollen from the tassels (male flowers) to the silks, which are elongated styles of the female flowers. Separate male and female flowers are also found on plants of the cucurbit family, which includes squash, cucumber, pumpkin, watermelon, muskmelon, cantaloupe, and gourd. In all of these plants, the sticky pollen of the male flowers must be transferred to the female flowers by insects. No fruit is produced without insect visits, and multiple visits, at least 8 to 12 per flower, are required to produce marketable muskmelons and watermelons. The size and shape of the mature fruit is usually related to the number of seed produced by pollination; each seed requires one or more pollen grains. Cucumbers may be misshaped, however, in spite of adequate pollination.

Honey bees are the most common pollinators of vegetable crops. They visit the plants to collect both nectar and pollen. Some of the pollen sticks onto their hairy bodies and is transferred from flower to flower. The number of honey bee colonies (hives) in Illinois has decreased from an estimated 232 thousand in 1947 to about 45 thousand in 1976. The latter figure represents less than one hive per square mile to provide pollination for all of our insect-pollinated crops. Growers should realize that there are not enough bees near their fields to produce the best possible yields.

Honey bees used for pollination can return far more than their cost. This is evident from recent studies of the quality of cucumbers grown for the fresh market. Experiments with commercial cucumber fields showed a pronounced reduction in the percentage of second-grade cucumbers, from more than a fourth of the yield

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where no bees were used to as low as 7 percent where two colonies were provided per acre. Considering the value of first-grade cucumbers on the early market, only a few bushels will pay for the bee rental. In the same experiments, yields increased to about three times the state average, depending on the length of harvest. Results were most favorable in fields of more than 15 acres. However, in the smaller fields with good yields, honey bees improved the quality of the cucumbers produced.

Honey bee on onion bloom. (Photo by W. P. Nye)

Bees help provide "crop insurance" when all other production factors are favorable. If pollination has been limiting, they will usually increase yields, improve quality, and produce a faster and more even set of fruit.

The value of fast, even fruit set can be important in raising pumpkins. Well-pollinated plants will produce good yields of fruit of fairly uniform size *throughout* the field. Such pumpkins will mature evenly and early, thereby making harvesting easier. You can check the adequacy of pumpkin pollination by walking through a field in the early morning. You should see bees in all parts of the field. If you do not, check to see if the female flowers are setting fruit or are dropping from the vines after a few days. An adequate population of bees will remove all the nectar from the flowers before they close each day. Flowers with nectar visible in them late in the morning probably will not produce a good pumpkin because of the lack of bee visits. You can literally pour nectar from unpollinated pumpkin flowers.

In experiments on pumpkin pollination at Urbana, we found that about 90 percent of the bees visiting pumpkin flowers were honey bees. As the number of bee visits per flower increased from 1 to 12, the percent of fruit set increased from 6.5 to 64.5. This means that growers will obtain a larger set of pumpkins if sufficient honey bees are present beside or in the field to provide repeated visits to pumpkin flowers during the short period each one is open.

The following insect-pollinated crops MUST be visited by bees to produce fruit:

Cucumber	Watermelon
Squash	Muskmelon
Pumpkin	Cantaloupe

The following crops set fruit without insect visits, but yields may be increased by honey bees:

Lima bean	Pepper	Soybeans
Okra	Eggplant	

Although they do not assist in the pollination of sweet corn, snap beans, tomatoes, field beans, and peas, bees may visit them for pollen and nectar. It is a good idea to check for the presence of bees before applying insecticides to these crops; otherwise, you may damage nearby colonies being used for pollination.

One strong hive of bees per acre will usually provide sufficient pollination for vegetable crops. An exception is hybrid cucumbers grown at high plant populations for machine harvest. The available hybrids, which are not completely gynoecious, require one hive of bees per 50 thousand plants per acre, or two hives for 100 thousand plants. Fully gynoecious hybrids may require more bees, even two or three times as many. Adjustments in the number of bees used may also be necessary on small fields and in locations where sweet clover and other plants compete strongly for the bees' attention. Overhead irrigation is detrimental to bee activity and should be done late in the day and at night if possible.

Do not place the bees beside the fields before the first female or perfect flowers appear. If placed too early, the bees will visit plants in bloom outside the field and will be less effective on the crop to be pollinated. In experiments with cucumbers for machine harvest, delaying pollination for as much as 11 days resulted in an increase in the number of fruits per plant and the value per acre. Such a delay may be practical in areas where there are few bees other than those moved for pollination.

For fields larger than 30 acres, place the bees in two or more groups around the fields, with a maximum of 1/10 of a mile between groups. The colonies need a nearby source of water such as a farm pond, stream, or lake. If this is not available, a stock tank or other large water container can be used, as long as cork floats or similar objects are provided as a place on which the bees can land when obtaining water.

Information about ways to avoid problems with pesticides and honey bees is available from your county Extension adviser. Insecticides are rated for their toxicity to bees, from highly toxic to relatively nontoxic. Highly toxic materials should not be applied to plants being visited by bees. If such materials are going to be used, make sure the bees are removed from the field first. Moderately toxic insecticides can be used on vegetable crops when the bees are not visiting the plants. For cucumbers and other cucurbits, the best time to apply insecticides is in late afternoon or evening, after the flowers have closed. Morning applications are less satisfactory because bees visit the flowers very early on hot days.

Honey bees tend to work close to their hives, but they may also visit neighboring fields as far as a mile away. They are attracted in large numbers to sweet corn when it sheds pollen, and are often killed by carbaryl (Sevin) applied for earworm control. Losses of bees can be reduced if the treatments are made late in the day by ground rig, with the nozzles set to keep the spray off the tassels. Highly toxic insecticides (such as parathion) applied to snap beans will kill the bees visiting the beans; such insecticides may also kill the bees in nearby cucumber and melon fields. Cooperation among growers is essential to prevent damage to honey bee colonies and to minimize a reduction in crop yields due to inadequate pollination of insect-pollinated plants.

To obtain a Pollination Agreement, a list of references about bees, or help with specific problems in pollination, contact your county Extension Adviser or the UI Extension beekeeping specialist: Elbert R. Jaycox, 107b Horticulture Field Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801.

References. BEEKEEPING IN THE MIDWEST, Extension Circular 1125. This 169-page book includes all the information needed to get started in beekeeping, including how to make some of the equipment. The book also includes tips and information of value to the established beekeeper, such as the fumigants approved for comb honey and empty combs. An extensive index helps to locate any subject.

Individual copies are $1.50 postpaid. Make checks payable to University of Illinois and send to:

Agricultural Publications Office
123 Mumford Hall
University of Illinois
Urbana, IL 61801

BEES AND HONEY, a monthly 4-page newsletter that gives you the latest ideas about managing bees, new research, the latest equipment, and lots of other information found nowhere else.

The subscription year is September to June, 10 issues for $4.00 or if you subscribe late, half a year, January to June, for $2.50. Make checks payable to the University of Illinois and send to:

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NET WEIGHT OF VEGETABLES IN CONTAINERS[1]

J. S. Vandemark

This list of the net weights of fresh vegetables sold in containers is useful for growers, market operators, and buyers. The weights given can only be approximate, since weight of a given volume of fresh produce varies with many factors. The density of a vegetable varies according to variety, season, weather, region where grown and with farm practices such as fertilization and irrigation. The figures should be considered as a guide rather than as an absolute measure.

There are no standard weights per bushel for fresh vegetables. The U.S. Departmen of Agriculture takes the position that the establishment of standard weights for such products is impracticable. However, the federal government has listed what it considers the average weight per bushel of most commodities. Many states prescribe by law or regulation the weight of a bushel.

Vegetable	Container	Cubic content (*inches*)	Net weight (*pounds*)
Asparagus	Pyramid crt.	1844	30-33
Beans, snap	Bushel	2150	28-30
Beets, topped	Bushel	2150	50-56
Broccoli	Bushel	2150	23-25
Cabbage, green (per unit volume wt. varies with variety and tightness of head)	Bushel	2150	31-34
	Carton	3763	50-52
Cabbage, storage	Sack		50
Carrots, topped	Bushel	2150	50
Chinese cabbage	Bushel	2150	48-50
Corn, green (usually sold by count, not wt.)	Bushel	2150	35-40
	W/B corn crt.	2166	35-40
Cucumbers	Bushel	2150	48-50
	1-1/9 bu.W/B crt.	2389	53-55

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Vegetable	Container	Cubic content (*inches*)	Net weight (*pounds*)
Eggplant	Bushel	2150	33-35
	1-1/9 bu. W/B crt. or ctn.	2389	37-39
Escarole-endive-chicory	Bushel	2150	25
	1-1/9 bu. W/B crt.		28
Greens (weight varies depending on tightness and wetness of pack)	Bushel	2150	18-23
	1-1/9 bu. W/B crt.	2389	20-26
Lettuce, greenhouse	24 qt. basket	1610	10
Onions, dry	Sack		50
	Bushel	2150	50-57
Parsley	Bushel	2150	20-25
	8 qt. basket	538	5-6
Parsnips	Bushel	2150	45-50
Peas, green	Bushel	2150	26-30
Peppers, green	Bushel	2150	25-30
	1-1/9 bu. W/B crt.	2389	28-33
Potatoes	Sack		100
	Bushel	2150	60
Squash (summer)	Bushel	2150	44
	8 qt. basket or crt.	538	10
Squash (winter)	Bushel	2150	50
Sweet potatoes	Bushel	2150	50
	Crate	2150	50
Tomatoes (greenhouse fruit are often shipped in 8 and 10 lb. baskets or cartons)	Bushel	2150	50-60
	8 qt. basket or ctn.	538	10-12
Turnips-rutabagas (topped)	Sack		50
	Bushel	2150	54-57

[1] *Adapted from United Fresh Fruit & Vegetable Association information*

Herbicide Guide 1978

FOR COMMERCIAL VEGETABLE GROWERS

Weed growth reduces the income of vegetable growers in the United States by millions of dollars annually as a result of lower yields, poorer quality, and added labor in harvesting and processing.

This guide should be used together with the grower's knowledge of soil types and the crop and weed history of the area to be treated. Whether to use herbicides or other means of weed control depends in part on the severity of past weed infestations. In many instances mechanical control is sufficient, or it may be needed in addition to herbicide use. Several herbicides may be suggested for some crops. These herbicides have shown good control with no injury to the vegetables under test conditions. Not all herbicides cleared for use on a species are necessarily listed. Where the choice of more than one herbicide is suggested, the decision rests with the grower and is based on his knowledge of past weed infestations, crop rotations, and material costs. Where one herbicide will not control the weeds present, a combination of herbicides may be suggested. When using an herbicide for the first time, use a small-scale trial.

These suggestions for chemical weed control in vegetables are based on research at the Illinois Agricultural Experiment Station, the U.S. Department of Agriculture, and other research institutions. The University of Illinois and its agents assume no responsibility for results from the use of these herbicides, whether or not they were used in accordance with suggestions recommendations, or directions of the manufacturer or any governmental agency.

Reading the label of the herbicide container is the most profitable time you spend in weed control. Use of the material and methods of application and use depend on registration of the herbicide by federal and state Environmental Protection Agencies (EPA). Do not use any herbicide *unless the label states that it is cleared for the use on the crop to be treated.*

Where mixtures of chemicals are applied, the *user* will assume the responsibility for freedom from residues if such applications are not labeled by the EPA as a mixture.

Suggestions sometimes change during the growing season, based on EPA clearances that were made after this circular was issued. This publication is printed only once each year, and is therefore subject to change without notification.

Watch for notice of changes in the EPA registration of herbicides (as released by the EPA) in the *Illinois Vegetable Farmer's Letter.* A subscription form for this newsletter is available from 116 Mumford Hall University of Illinois, Urbana 61801.

Note: In the suggestions table on the following pages, the trade names of the herbicides are usually used. The list below shows trade names and their corresponding common names.

Common name	Trade name	Common name	Trade name	Common name	Trade name
alachlor	Lasso	cycloate	Ro-Neet	MCPB	(numerous ones)
atrazine	AAtrex and others	dalapon	Basfapon, Dowpon	metribuzin	Lexone, Sencor
benefin	Balan	DCPA	Dacthal	naptalam	Alanap
bensulide	Prefar	dinitramine	Cobex	nitrofen	TOK
bentazon	Basagran	dinoseb	Premerge-3, Sinox	profluralin	Tolban
butylate	Sutan+	diphenamid	Dymid, Enide	propachlor	Bexton, Ramrod
CDAA	Randox	diuron	Karmex	pyrazon	Pyramin
chloramben	Amiben, Vegiben 2E	EPTC	Eptam, Eradicane	simazine	Princep
chlorbromuron	Maloran	glyphosate	Roundup	trifluralin	Treflan
chlorpropham	Furloe	linuron	Lorox	Petroleum solvent	Stoddard Solvent
cyanazine	Bladex	MCPA	(numerous ones)	2,4-D (amine)	(numerous ones)

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN   COLLEGE OF AGRICULTURE   COOPERATIVE EXTENSION SERVICE
Prepared by H. J. Hopen, Department of Horticulture (revised annually)   CIRCULAR 907 (October, 1977)

	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Best time of application (based on crop stage)	Remarks, cautions, limitations
u ;s	Amiben	3 lb.	Annuals	Immediately after seeding	Irrigation or rainfall after treatment will give maximum control.
u hl	dalapon	5-10 lb.	Perennial grass	End of harvest season following disking	Apply when grass weeds are 3 to 4 inches tall. Direct spray under fern growth. Use surfactant as directed on label.
s	Karmex	1-4 lb.	Annuals	In spring before spears emerge or immediately following harvest, or both	Apply after disking. Do not exceed 6 pounds per growing season. Use lighter rate on sandy soil.
	Princep	3-4 lb.	Annuals	In spring and after harvest	Apply after disking. Do not treat during last year in asparagus because of residue. With Karmex and Princep — usually weed infestation will be reduced and spring application may be sufficient after the first year.
n.	Amiben	2-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	Field may be rotary-hoed without destroying herbicide action.
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Plant crop immediately, or within 3 weeks after application. Can be used up to 1 pound on dry beans.
n)	Eptam	3 lb.	Annual grasses and nutgrass[3]	Preplant soil application, incorporate with soil immediately	
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Plant crop immediately or within 3 weeks after application.
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	Do not feed treated plant parts to livestock.
	Vegiben 2E (2E *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	This ester form of chloramben may leach less readily in sandy soils. Use on other than sandy soils.
r	Cobex	0.3-0.6 lb.	Annuals	Preplant soil incorporation	
r lap	Tolban	0.5-1 lb.	Primarily annual grasses	Preplant soil incorporation	
	Premerge-3	6-7.5 lb.	Annuals	Can be used between planting and crop emergence	Do not use on light, sandy soil. Some stand reduction may result from use. See label for precautions.
uen	Pyramin	4 lb.	Annuals (primarily broadleaved)	Preemergence or after beets emerge and before weeds have two true leaves	Rainfall or irrigation needed to activate. Where grasses are a severe problem, use 4 pounds of Pyramin plus 4 pounds of Ro-Neet.
	Ro-Neet	4 lb.	Annual grasses	Preplant soil application, incorporate with soil immediately	Use a combination treatment with Pyramin to broaden control spectrum.
	Preemergence — direct-seeded				
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Stunting or growth reduction may occur at recommended rates under growth stress conditions.
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding. Can also be incorporated preplant	Can also be used preemergence on transplants.
	Preemergence — transplanted				
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Transplant after application to 3 weeks later.
	Postemergence — direct-seeded or transplanted				
	TOK[5]	3-6 lb.	Broadleaved weeds[6]	One to two weeks after crop emergence or transplanting, while weeds are in seedling stage	Use wettable-powder formulation to reduce injury potential. Use in combination with preplant or preemergence material for annual grass control.
	Preemergence				
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Seed after application to 3 weeks later.
	Postemergence				
	Lorox	0.75-1.5 lb.	Annuals	Postemergence on carrots only after the crop is 3 inches tall; grasses, less than 2 inches; broadleaves, less than 6 inches	Do not feed treated foliage to livestock or replant treated area for 4 months. More than one application may be made, but do not exceed a total of 2 pounds per acre. Do not use over 40 PSI. Use no surfactants when temperatures exceed 80°F., or crop injury may result.
	TOK	3-6 lb.	Broadleaved weeds[6]	While weeds are in the seedling stage	Can also be used on celery and parsley. Use in combination with preplant or preemergence material for annual grass control.
	Stoddard Solvent	60-80 gal.	Annuals	After two true leaves have appeared (do not apply to carrots or parsnips after they are ¼ inch in diameter, since an oily taste may result)	Most effective when sprayed on cloudy days or during high humidity, and when weeds are not more than 2 inches high. May not control ragweed. Do not apply within 40 days of harvest. Can also be used on celery, dill, parsnips, and parsley.

s on page 3.)

Crop	*Treatment*	*Active ingredient per acre actually covered*[1]	*Weeds controlled*	*Best time of application (based on crop stage)*	*Remarks, cautions, limitations*
	Preemergence				
Corn, pop	atrazine	2-3 lb.	(See sweet corn)	(See sweet corn)	See sweet corn, *except the section on combinations*
	Princep	2-3 lb.	Annuals	Preemergence	Plant only crops so specified on the label the follo Do not graze treated areas.
	Postemergence				
	2,4-D	0.5 lb.	Broadleaved weeds	Postemergence	Apply when corn is 3 to 10 inches tall.
	Roundup	2-3 lb.	(See remarks)	(See remarks)	Use for quackgrass or Johnsongrass control. quackgrass when 6 to 8 inches tall in fall or spr to Johnsongrass when at least 12 inches tall an growing. Do not till until 3 to 7 days after app
	Preemergence				
Corn, sweet	atrazine	2-3 lb.	Annuals, annual and perennial grasses[7]	Preemergence, apply no later than 3 weeks after seeding Shallow cultivation may improve weed control during dry weather	Grow corn a second year without atrazine treat chemical has a high soil residue. Do not plant c table crops on a sprayed area until a second year been grown. Use atrazine where quackgrass is Residue hazard decreased when banded or in cc with Lasso, propachlor, or Sutan.
	Bladex	(See remarks)	Annuals	Preemergence only	Some sweet corn varieties are sensitive to the rate. Has been shown to have less soil residual tha See label for rates and precautions. Do not use gence, or on sandy or loamy-sandy soils. Can be with other herbicides to reduce the rate being u
	Lasso	2-2.5 lb.	Annuals	Preemergence	Preplant incorporation may aid control of nutgr apply in nitrogen solutions.
	propachlor	4-5 lb.	Annuals	Preemergence	Do *not* use on sandy soils. Is an excellent herbici with a high organic-matter content.
	Sutan +	3-4 lb.	Primarily annual grasses	Preplant soil application Incorporate with soil	Use on sandy soil and where nutgrass is a problen
	Eradicane	4 lb.	Difficult to control weeds such as wild cane, nutsedge, quackgrass, and seedling Johnsongrass	Preplant soil application, incorporate with soil	Use to control weeds that are difficult to control herbicides, such as wild cane, nutsedge, quack seedling Johnsongrass.
	Preemergence combinations				
	atrazine plus Lasso	1.5 lb. +2 lb.	Annuals and perennial grasses	Preemergence or preplant incorporated	See label for slightly higher rate of Lasso for p corporation.
	atrazine plus propachlor	1.5 lb. +3 lb.	Annuals and perennial grasses	Preemergence	Use to reduce atrazine residue.
	atrazine plus Sutan +	1 lb. +3-4 lb.	Annuals and perennial grasses	Preplant soil incorporation Incorporate with soil immediately	Use where nutgrass is a problem and to redu residue.
	Postemergence				
	2,4-D (amine)	0.5 lb.	Broadleaved weeds	Postemergence	Preferably, apply before corn is 6 inches tall. If 12 inches, reduce the rate to ¼ pound.
	atrazine	2 lb.	Annuals, annual and perennial grasses[7]	Directed spray 3 weeks after emergence	Can be combined with crop oils for postemerger tion as an emergency measure. This may increase following year. Preemergence use preferred. D or feed treated foliage for 21 days after treatm
	Basagran	0.75-1 lb.	Broadleaved annual weeds, Canada thistle, and nutsedge. Will not control grass weeds	Early postemergence when the weeds are small and actively growing. Delay will result in less control	TRIAL USE IN 1978. For Canada thistle an split applications are preferred. Make first on plants are 6 to 8 inches tall; for nutsedge, 7 to 10 for Canada thistle, 10 to 14 days later.
	Perennial grass control, applications outside the growing season				
	Roundup	2-3 lb.	(See remarks)	(See remarks)	Use for quackgrass or Johnsongrass control quackgrass when 6 to 8 inches tall in fall or sp to Johnsongrass when at least 12 inches tall a growing. Do not till until 3 to 7 days after applic not provide residual weed control. Do not mi apply Roundup spray solutions in galvanized lined steel containers (except stainless steel) or sp

[1] Based on active ingredients (actual amount of active herbicide in material or acid equivalent). Use lower rate on sandy soil and higher rate on clay and loam using a band application over the row, adjust amount of material applied to the part of an acre treated. See Illinois Circular 1047. [2] May not control ragweed [3] May not control smartweed. [4] May not control ragweed, smartweed, and velvetleaf. [5] Use of 50% wettable powder is suggested for cabbage and horseradish. [6] Ma ragweed or chickweed. Grass control is sometimes marginal. [7] May not control crabgrass. [8] Do *not* use Alanap Plus, Solo, Whistle, or Amoco Soybean herbicide. Th all contain Alanap plus another ingredient that may cause injury. [9] May not control smartweed and velvetleaf.

	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Best time of application (based on crop stage)	Remarks, cautions, limitations
bis ens ions	Alanap[8]	3-5 lb.	Annuals[3]	Immediately after seeding or transplanting	Do not use on cold soil. Rainfall or irrigation after treatment gives maximum control.
		3-3.5 lb.		After transplanting or vining	Use granular form. Keep away from foliage. Apply to soil after the weeds have been removed.
	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Is primarily a grasskiller. Consult label for sensitive crops within 18 months after application. Prefar can be used in rotation with tomatoes, broccoli, cauliflower, lettuce, carrots, onions, and summer squash within 18 months of application.
	Prefar plus Alanap[8]	4 lb. +2-3 lb.	Grasses and broadleaved weeds	Preplant soil incorporation for Prefar; Alanap, as an immediate postseeding application	Has value for broad-spectrum weed control. Consult label for sensitive crops within 18 months after Prefar application. Has EPA approval as a tank mixture.
	Vegiben 2E (2E form *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	This ester form of chloramben may leach less readily in sandy soils. Above 1.5 to 2 pounds per acre, injury chances increase under moist soil conditions. Some muskmelon cultivars may be susceptible to Vegiben injury.
	As an alternative to herbicides where earliness is desired, black polyethylene mulch will control annual weeds, conserve moisture, and increase early spring soil temperatures.				
n	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	After plants are established, 4-6 weeks after transplanting	Cultivate and weed prior to application. Can be applied to plants as part of a uniform soil application.
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	For use on collards, kale, mustard greens, and turnips.
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application. Incorporate with soil immediately	For use on collards, kale, mustard greens, and turnip greens.
	Furloe	1-2 lb.	Primarily broadleaved annuals	Preemergence	For spinach only. Use lower rates in cool, wet weather.
ch	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after transplanting	Use for annual grass control and combine with TOK as an early postemergence treatment for broadleaved weeds.
	TOK[5]	3-6 lb.	Broadleaved weeds[6]	Before weeds are 1 inch tall	Will not consistently control weeds over 1 inch tall. Some emerging annual grass may be controlled by this treatment. Lower rate will control seedling purslane.
	Balan	1.5 lb.	Annuals	Preplant soil incorporation Incorporate with soil immediately	Is primarily a grasskiller. Seed after application to 3 weeks later. Do not plant wheat, barley, rye, grass, onions, oats, beets, or spinach for 12 months after application.
	Preemergence				
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding or transplanting	May not kill smartweed or common ragweed. Can be used on seeds, sets, or seedlings. Use only on mineral soils. Use lower rates on sandy soils. A double application of Dacthal can be used at seeding, layby, or both. In most situations, the weed spectrum on mineral soils will respond well to a combination of Dacthal preemergence and TOK postemergence.
	Randox	4-6 lb.	Annuals[9] (primarily grasses)	Just before onions emerge	Use on muck soils. Heavy rainfall may reduce stand. Very effective on purslane and pigweed.
	Postemergence				
	TOK	3-4 lb.	Broadleaved weeds	When weeds are in seedling stage and not over 1 inch tall	Use a single application of E.C. or W.P. per growing season. Do not apply E.C. until onions are in the two- to three-leaf stage. *Preemergence* use of TOK with heavy rainfall may reduce stand. Use in combination with preplant or preemergence material for annual grass control.
	Furloe	3-6 lb.	Broadleaved weeds (especially smartweed)	On seeded onions: loop stage or after three- to four-leaf stage	In the later sprays, direct at base of onion plant. If more than one application is applied do not exceed 6 pounds per acre for the season. *Use lower rates in cool, wet weather.* Use no later than 30 days before harvest.
	propachlor	4-4.9 lb.	Annuals	Preemergence	Do *not* use on sandy soil.
	Treflan	0.5-0.75 lb.	Annuals[2]	Preplant soil incorporation Incorporate with soil immediately	Seed after application to 3 weeks later. Some reduction of growth and stand reduction possible under stress.
	Cobex	0.3-0.5 lb.	Annuals	Preplant soil incorporation	
	MCPB	1 lb.	Broadleaved weeds and Canada thistle	When peas are 3-7 inches tall and no later than four nodes prior to pea blossom	May delay maturity 1 to 4 days. Use at least 20 gallons of water per acre. Do not feed vines to livestock.
	MCPA	0.25-0.5 lb.			MCPA is more effective on mustard. MCPB is less injurious to peas.
	Premerge-3	0.3-9 lb.	Annuals (primarily broadleaved weeds)	Preemergence or postemergence	Preemergence use 6 to 9 pounds; postemergence, use 0.3 pound to 1.1 pounds. Apply prior to bloom when peas are 2 to 8 inches tall. See label for further precautions.

(…tes on page 3.)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Best time of application (based on crop stage)	Remarks, cautions, limitations
Potatoes, Irish	Eptam	3-6 lb.	Annual grasses and nutgrass[3]	Drag-off treatment at emergence or preplant soil application Incorporate with soil immediately	Use lower rate on sandy soil.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Drag-off treatment at emergence	Use a light incorporation.
	Lorox	0.75-2 lb.	Annuals	Apply prior to potato emergence	Plant tubers at least 2 inches deep. Do not rep[illegible] area to other crops for 4 months after treatm[illegible] jure crop on light, sandy soil. Do not apply [illegible] tubers.
	chlorbromuron	2-3 lb.	Annuals	At very start of potato emergence	May injure crop on light, sandy soil. Do not [illegible] mature potatoes. Do not plant crops other tha[illegible] potatoes, or soybeans for 6 months after app[illegible]
	dalapon	7 lb.	Quackgrass	Before plowing in spring; wait 4 days before plowing and planting	Not for fields intended for red-skinned variet[illegible] Rose. Do not plant potatoes for 4 weeks. Us[illegible] as directed on label.
	metribuzin	0.25-0.5 lb.	Annuals (primarily broadleaved)	Postemergence, following a preemergence grass herbicide	Can be used preemergence also. Do not exceed [illegible] acre in a season. Do not apply within 60 day[illegible] Do not use on red-skinned or early maturin[illegible] rieties. Do not apply in cool, wet weather.
	Lasso	2.5-3 lb.	Annuals	Apply at drag-off	Do not use on sandy soils. Can be used alone o[illegible] tion with Lorox or dinoseb.
Potatoes, sweet	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after planting	May not control smartweed or common ragwe[illegible] on sandy soil.
	Amiben	3 lb.	Annuals	Immediately after planting	Preferred on loam soils.
Spinach	Furloe	1-2 lb.	Annuals	Immediately after seeding	Use 1 pound if the temperature is below 60°F
Squash Pumpkins	Amiben	3-4 lb.	Annuals	As soon after seeding as possible	Use on loam soils. In Illinois, Amiben can be a[illegible] cast or banded over the row in pumpkins.
Squash	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application Incorporate with soil immediately	Is primarily a grasskiller. Consult label for se[illegible] within 18 months after application. Prefar c[illegible] rotation only with tomatoes, broccoli, caulifl[illegible] carrots, onions, and summer squash within [illegible] application. Use in combination with Alanap as suggested f[illegible]
Tomatoes, direct-seeded	Dymid, Enide	4-6 lb.	Annuals	Preemergence	Do not plant other food crops on treated areas [illegible] If used under dry soil conditions, a shallow [illegible] corporation as a preplant treatment may i[illegible] control. Can also be used on transplanted tomatoes [illegible]
Tomatoes and Peppers, transplanted	Amiben	3-4 lb.	Annuals	Wait 3 days after transplanting to apply	Use granular formulation only. Apply to dry f[illegible] to avoid leaf burn. Do not use on sandy soils
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application Incorporate with soil immediately	Some reduction of growth may be possible [illegible] stress conditions, or if rates are higher than [illegible] the soil type.

(See footnotes on page 3.)

1978 Suggested Fungicide Guide | Fungicide Guide for COMMERCIAL VEGETABLE GROWERS

Vegetable fungicide tolerances and intervals approved by the Food and Drug Administration and the Environmental Protection Agency as of October 1, 1977, are presented in this publication. The tables on pages 2 and 3 give the tolerances in parts per million (ppm) and the number of days between the last application at normal rate and the harvest *or* they give the date of last application that will keep residues within tolerances set by the FDA.

The listing of a chemical for a crop does not necessarily constitute recommendation for control of a disease on that crop by the Illinois Cooperative Extension Service or the Agricultural Experiment Station. Specific recommendations are given on pages 4 to 7.

In some instances a tolerance (ppm) has been set but a definite interval has not been established. The absence of an interval does not necessarily mean that the fungicide may not be used on that crop. Use of the fungicide would require such restrictions as "do not apply after first blooms appear" or "do not apply after edible parts form."

In a few cases the interval and dosage have been established, but the allowable ppm residue has not been determined. Here again this does not mean that the fungicide may not be used on that crop. It does mean, however, that until a tolerance is established it must be considered to be zero. Zero tolerances are reviewed each year. Some are cancelled as the manufacturer supplies the EPA with additional data.

Growers must follow a disease control program that will assure the production of vegetables with no excessive fungicide residues. Vegetables marketed with residues exceeding FDA tolerances may be injurious to consumers, may be confiscated, and may cause the grower to be brought to court.

Growers have nothing to fear from the law so long as they use fungicides and other pesticides according to the current label only on the crops specified, in the amounts specified, and at the times specified. The safe grower keeps a record of the products and trade names used, the percentage of active ingredients, dilutions, rates of application per acre, and dates of application. The record sheet provided on page 8 is a convenient place to keep such information.

This circular will be revised each year. Be sure you have the most up-to-date copy.

Prepared by Barry Jacobsen and M. C. Shurtleff, Department of Plant Pathology

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
Urbana, Illinois Circular 999 November, 1977

Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture.
JOHN B. CLAAR, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign.
The Illinois Cooperative Extension Service provides equal opportunities in programs and employment.

FUNGICIDE USES FOR VEGETABLES, APPROVED BY THE EPA, OCTOBER 1, 1977[a, b]

Crop	Benlate, 0.2-15 ppm	Captan (D) (See ppm below)	Bravo, 0.1-15 ppm	Di-folatan, 0.1-15 ppm	Dyrene, 10 ppm	maneb, 4-10 ppm maneb with zinc salt	mancozeb[c] (See ppm below)	zinc 4-25
Asparagus	..	root dip	..	..	..	A[d]	(0.1 ppm), A	A
Beans (dry, lima, snap) lima	14,[e] B (snap only) 28	(25 ppm), pp, 0[e]	7,[e] B (snap only)	..	..	0[e] 4 on limas or snap	..	7[e],
Beet, garden	..	(2 ppm-root, 100 ppm-greens), 0, pp	..	..	..	..	..	7(to
Broccoli	..	(2 ppm), pp	0[e]	..	..	(10 ppm), 3 or trim and wash	..	7
Brussels sprouts	..	(2 ppm), pp	0	..	..	7	..	..
Cabbage	..	(2 ppm), pp	0	..	..	(10 ppm), 7	..	7
Cantaloupe (muskmelon)	0	(25 ppm), 0, ph,[d] pp	0	0[e]	0[e]	5	(0 ppm in edible parts), 5[e]	5
Carrot	..	(2 ppm), 0	0	..	..	(7 ppm), 0	(2 ppm) 7, B (tops)	7(to
Cauliflower	..	(2 ppm), pp	0	..	..	0	..	7
Celery	(3 ppm), 7	(50 ppm), 0, pb	7	..	0	(5 ppm), strip and wash, 14	(5 ppm), 14	strip wash
Chinese cabbage	..	..	..	..	..	..	..	7
Corn, sweet and pop	..	(2 ppm), 10, B, pp	14, B[f]	..	..	..	(0.5 ppm-cob and kernel), 7 (5 ppm-fodder and forage, 0.5 ppm-ears)	0, B,
Cucumber	(1 ppm), 0	(25 ppm), 0, ph, pp	0	0	0	(4 ppm), 5	(4 ppm), 7	5
Eggplant	..	(25 ppm), 0, ph, pb	..	..	..	0	..	0
Endive, escarole	..	..	..	..	..	(10 ppm), 7 and wash	..	10
Fennel	..	..	..	..	..	..	7	..
Kale, collard	..	(2 ppm), pp	..	..	..	(10 ppm), 10 and wash	..	10
Kohlrabi	..	..	..	..	..	0	..	(halfg
Lettuce	..	(100 ppm), 0	..	..	..	(10 ppm), 7 (strip and wash)	..	10
Mustard greens	..	(2 ppm), pp	..	..	..	(10 ppm), 10 and wash	..	10
Onion	..	(50 ppm green, 25 dry), 0, ph	0	0	0	(7 ppm), 0	(0.5 ppm dry), 7, D	10
Peas	..	(2 ppm), pp	..	..	..	..	..	10
Pepper	..	(25 ppm), 0, pb, pp	..	..	..	(7 ppm), 0	E	0
Potato, Irish[d]	..	(25 ppm), 0, ph	0	0	0	(0.1 ppm), 0, C	(1.0 ppm), 0	0 and C,
Pumpkin	..	(25 ppm), 0, pp	0	..	0	(7 ppm), 0	..	0
Radish	..	..	..	..	0	..	..	0
Rhubarb (greenhouse)	..	(25 ppm), 0	..	..	..	(10 ppm), 0	..	..
Spinach	..	(100 ppm), 0, pp	..	..	..	7 and wash	..	10
Squash	(1 ppm), 0	(25 ppm), 0, pp	0	..	0	(7 ppm), 5	(4 ppm), 5	5
Sugar beet[d]	(0.2 ppm-roots, 15 ppm-tops), 21	0	..	..	..	10, B, C, 14, no feeding restrictions	(2 ppm-roots, 65 ppm-tops), B, 14	..
Swiss chard	..	0	..	..	..	..	..	10
Tomato	(5 ppm), 0	(25 ppm), 0, pp	0	0[g]	0	(4 ppm), 5, F	(4 ppm), 5	5
Turnip, rutabaga	..	(2 ppm), pp	..	..	..	10 and wash	..	(7 pp to
Watermelon	(1 ppm), 0	(25 ppm), 0, pp	0	0	0	5	(0 ppm edible parts), 5[e]	5

[a] No tolerances have been set for these fungicides on dill, horseradish, okra, parsley, and parsnip.
[b] The following abbreviations are used:
- A = Post-harvest application to ferns only or to young plantings that will not be harvested.
- B = Do not feed treated tops or forage to livestock.
- C = Do not use treated seed or seed pieces for feed or food.
- D = Do not apply to exposed bulbs.
- E = Do not apply after fruit buds form.
- F = To avoid damage, do not use on tender young plants.
- pb = Plant bed treatment.
- ph = Post-harvest spray or dip.
- pp = Preplant soil treatment.

[c] Mancozeb is sold as Dithane M-45 and Manzate 200.
[d] Tolerances are not needed for pesticides applied only to the foliage and not translocated to the tubers or roots.
[e] Number indicates number of days between last application and harvest; 0 = up to harvest.
[f] Do not apply if crop is to be used for processing.
[g] Machine harvest only.

LABEL INFORMATION ON FUNGICIDES OF LESS GENERAL USE

de (tolerance)	Crops and use restrictions
	Beans (snap) — white mold, 2 days to harvest. Do not feed forage to livestock. **Greenhouse tomato** — to harvest. Do not drench seedlings or newly set transplants. **Carrot** — post-harvest dip or spray, see label. **Garlic, Onion** — soil application before seeding or spray to soil around sets or bulbs. *Do not plant spinach* as follow-up crop in treated soil. **Leaf lettuce** (greenhouse) — 14 days[a] (do not apply to wilted plants or seedlings). **Head lettuce** — 14 days. **Celery** — 7 days. **Cucumber** (greenhouse) — see label. **Rhubarb** (greenhouse) — 3 days. **Potato** — 14 days (do *not* feed to livestock). **Sweet potato** — root dip and plant bed treatment. Note: Do not plant tomatoes as followup in treated soil. Don't use spent roots for food or feed. Post-harvest spray or dip as directed.
fungicides[b] basic copper sulfate (Kobasic, Triangle, Tri-basic Copper Sulfate, etc.)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, potato, pumpkin, radish, spinach, squash, tomato, watermelon.**
pper sulfate (many)	**Bean, broccoli, cabbage, cantaloupe, cassaba melon, cauliflower, celery, cucumber, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, watermelon.**
pper resinate (Citcop 4E, Cop-O-Cide, Emulsifiable Liquid Copper Fungicide)	**Bean, cantaloupe, cauliflower, chinese cabbage, cucumber, honeydew melon, lettuce, onion, pepper, pumpkin, squash, tomato, turnip, watermelon.**
pper ammonium carbonate (Copper-Count N)	**Bean, cabbage, carrot, crenshaw melon, celery, cantaloupe, cassaba melon, cucumber, honeydew melon, lettuce, muskmelon, pepper, Persian melon, potato, squash, tomato, watermelon.**
pper hydroxide (Kocide 101 and 404)	**Bean, cantaloupe, carrot, celery, cucumber, honeydew melon, muskmelon, pepper, potato, pumpkin, squash, tomato, watermelon.**
pper oxychloride sulfate (COCS, Copro 50 and 53)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cassaba melon, cauliflower, celery, crenshaw melon, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, Persian melon, potato, pumpkin, spinach, squash, tomato, watermelon.**
rdeaux mixture (Acme Bordeaux mixture, Pattersons Bordeaux mixture, Bor-Dox, Ortho Bordo mixture, etc.)	**Cress, cucumber, eggplant, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, turnip, watermelon.**

Fungicide (tolerance)	Crops and use restrictions
Dexon	Cleared *only* for seed-treatment use on beans, beets, corn, cucumbers, peas, spinach, sugar beets. Do not use treated seed for food, feed, or oil. Slurry seed treatment for planting in light soils or soils high in clay or organic matter.
dinocap (Karathane)	Cantaloupe (muskmelon), cucumber, honeydew melon, pumpkin, squash, watermelon — 7 days. For control of powdery mildew only.
etridiazole (Terrazole, Truban)	Seed treatment: **Beans, peas, sugar beets.**
polyethylene polymer (Polyram) (0 ppm)	**Potato, sugar beet** — no time limitations. **Celery** — 14 days. **Cantaloupe, cucumber, tomato** — 5 days. Do *not* feed sugar beet tops to meat or dairy animals. **Celery** — strip, trim, and wash. Post-harvest application to asparagus ferns.
PCNB (Terraclor, Brassicol, Fungiclor) (0.1 ppm)	**Beans** — base of plants *before* blossoming, soil and seed treatment at planting, or foliar spray. Do *not* feed treated Bean vines to livestock. Do *not* apply after first bloom. **Broccoli, brussels sprouts, cabbage, cauliflower** — transplant solution (¾ pint per plant) or row treatment before transplanting. **Pepper, potato, tomato** — soil treatment at or before planting. **Tomato** (field use only) — transplant solution (½ pt. of 0.2% per plant). **Garlic** — soil and seed treatment at planting.
streptomycin (0.25 ppm)	**Celery, pepper, tomato** — plant beds only (200 ppm spray); **Potato** — seed-piece treatment only (100 ppm dip or dust). Soak cut seed pieces less than 30 min. **Beans** — seed treatment for halo blight control. Do not use treated seed for food or feed.
sulfur, lime, and lime-sulfur	Exempt when used with good agricultural practices. See label.
thiabendazole (Mertect)	**Sweet potato** — "seed" root treatment. Do not use treated pieces for food or feed. **Potato** — "seed" tubers only (1,500 ppm-20 sec. dip.
thiram, TMTD (0.5-7 ppm)	**Onion** — Furrow treatment. **Celery** — 7 days (strip, trim, and wash). **Sweet potato** — preplant root dip. **Tomato** — 0 days, for leaf spots and fruit rots. Seed treatment: **Beans, beets, broccoli, brussels sprouts, cabbage, cantaloupe, carrot, cauliflower, collard, corn, cucumber, eggplant, endive, kale, kohlrabi, lettuce, okra, onion (bulb, seed, and set), peas, pepper, pumpkin, radish, spinach, squash, swiss chard, tomato, turnip, watermelon.** WARNING: Do not use treated seed for food, feed, or oil.
triphenyltin (Du-Ter)	Potato — early and late blight. May be applied through irrigation systems (solid set or center pivot only).

umber of days between last application and harvest.
nere are many other copper materials, but these are most widely available and labeled for use on vegetable crops. Exempt from tolerance if used with good ıral practices; not exempt if used at time of or after harvest. See label.

CONDENSED FUNGICIDE RECOMMENDATIONS FOR DISEASES OF COMMERCIAL VEGETABLE CROPS FOR 1977

Vegetable	Diseases	Fungicide[a]	Remarks
Asparagus	Rust (RPD934)[b], leaf and branchlet blights	zineb, maneb, mancozeb, or Polyram	Apply to non-harvested fields *throughout* season to August 1 to harvested fields *after* cutting only. Apply at 7- to 10-day intervals. May combine with insecticides to control asparagus beetles, cutworms, etc. (Cir. 897).[b] Polyram on ferns only.
	Root rots	mancozeb, captan	Use as a preplant dip.
Beans (garden, wax, and lima)	Seed decay (RPD915), damping-off, and seed-borne stem blights and root rots	thiram, captan, Terrazole, or chloroneb plus insecticide	Treat seed any time if not previously treated by producer. Plant *only certified*, western-grown seed in warm soil above 65° F.
	Bacterial blights	fixed copper (2-3 lb. metallic/A.)	Apply at weekly intervals. Plant *only certified* western-grown seed.
	Rust, anthracnose, fungus leaf spots, pod and stem spots	maneb, zineb, or Bravo	Apply at 7- to 10-day intervals during moist weather. Combine with insecticides to control bean beetles, aphids, leafhoppers, blister beetles, etc. (Cir. 897).
	Mosaics		Use insecticides to control aphids (NHE-47)[b] that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Control weeds in and around fields (Cir. 907).
	White mold	Botran, PCNB, benomyl	Apply to base of plants just before bloom, or at 25-50% bloom (benomyl). Do not feed treated vines to livestock.
Beets (garden and sugar), Spinach, Swiss chard	Seed rot (RPD915), damping-off, and seed-borne leaf spot and anthracnose	thiram or captan	Treat seed any time or buy treated seed. To control damping-off apply captan (5-7 lb. of 50% WP in 25-30 gal. water/A. or 25-30 lb. of 10% dust/A.) in furrow at planting time.
	Cercospora leaf spot (RPD951), downy mildew	zineb or fixed copper (2-3 lb. metallic/A.)	Apply every 1 to 2 weeks during rainy periods. May combine with insecticides to control aphids, leafhoppers, caterpillars, leaf miners, etc. (Cir. 897).
	Mosaics, virus yellows		Use insecticides to control aphids (NHE-47) and plant bugs that transmit the viruses. Kill insects before they feed (Cir. 897).
Broccoli, Brussels sprouts, Cauliflower, Cabbage, Chinese cabbage, Collard, Mustard, Kale, Kohlrabi, Radish, Rutabaga	Seed rot (RPD915), damping-off, black rot (RPD924), blackleg (RPD955), radish black root (RPD948), Alternaria blight	hot water, then thiram or captan	Buy western-grown seed. Sow *only* seed treated with hot water. Control cabbage root maggots, cutworms, cabbage worms, etc. (Cir. 897). Four-year rotation with non-crucifer crops.
	Wirestem (*Rhizoctonia*) (RPD902), damping-off, seed rot (RPD916), Botrytis blight (RPD942)	PCNB-captan mixture	Dust or spray on soil just before, at, or after planting seed. Follow manufacturer's directions.
	Clubroot (RPD923)	PCNB 75	Apply in transplant water or starter solution, ¾ pt. per plant (about 400 to 600 gal./A.). Do *not* use emulsion form of PCNB.
	Downy mildew, leaf spots, white rust (RPD960), anthracnose, Botrytis blight (RPD942)	maneb, zineb, or Bravo	Apply at 5- to 7-day intervals (3-5 days for radish) in wet weather. Use maneb in seedbed(2 lb./100 gal.). Good coverage important. May need spreader-sticker. May combine with insecticides to control aphids, cabbage worms, etc. (Cir. 897).
	Mosaics, black ringspot		Use insecticides to control aphids (NHE-47) and cabbage worms (NHE-45) that transmit the viruses. Kill insects *before* they feed — especially in seedbeds (Cir. 897).
	Brittle root (primarily horseradish)		Use insecticides to control leafhoppers that transmit the virus (Cir. 897). Apply when leafhoppers are *first* noticed. Additional applications may be necessary if infestation is severe.
Horseradish	Leaf spots	fixed copper	
Carrot, Parsnip	Seed rot (RPD915), damping-off	thiram or captan	Treat seed any time. May combine with insecticides.
	Aster yellows (RPD903)		Use insecticides to kill leafhoppers that transmit the mycoplasma, *before* they feed (Cir. 897). Begin when plants are 2-3 inches tall; apply weekly for 4 weeks. Control weeds in and around plantings (Cir. 907).
	Cercospora leaf spot, Alternaria leaf blight (RPD938)	captan, maneb, mancozeb, zineb, or Bravo	Apply at 5- to 10-day intervals in rainy periods. Thorough coverage essential. Start around June 15.

[a] Dosages: The quantity of material listed is the pounds of active (actual) ingredient to be applied to 1 acre unless stated otherwise (i.e., 3 lb./A., 6 lb. 50% WP; 20 lb. 5% dust). Abbreviations used: A = acre; WP = wettable powder; pt. = pint(s); gal. = gallon(s); T. = tablespoon(s) (level); sq. ft. = square foot or feet.

[b] RPD = Report on Plant Diseases; NHE = Natural History Entomology publication. General references: Circular 897, Insect Pest Management Guide — Commercial Vegetable Crops and Greenhouse Vegetables; and Circular 907, Herbicide Guide for Commercial Vegetable Growers. Materials available in County Extension Offices.

CONDENSED FUNGICIDE RECOMMENDATIONS (continued)

Vegetable	Diseases	Fungicide	Remarks
(lery, ırsley	Seed rot (RPD915), damping-off, seed-borne blights	hot water, then thiram or captan	Treat seed just before planting or buy treated seed. If damping-off starts, spray plants and soil 2 to 3 times, 5-7 days apart. Use zineb (1 T./gal.). Three-year-old seed is free of late blight.
	Leaf blights and leaf spots	maneb, zineb, benomyl, Dyrene, Bravo, mancozeb	Apply every 7-10 days in field except during very dry weather.
	Mosaics, calico, ringspot		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Control weeds in and around plantings (Cir. 907).
	Aster yellows (RPD903)		Use insecticides to control leafhoppers that transmit the mycoplasma. Kill insects *before* they feed. Control weeds in and around plantings (Cir. 907).
orn (sweet and pop)	Seed rot (RPD915), seedling blights, seed-borne root and stalk rots, leaf blights	Captan, zineb, Vitavax-thiram, or thiram *plus* insecticide	Treat seed any time or buy seed treated with both a fungicide and an insecticide (NHE-27).
	Bacterial wilt (RPD907)		Apply insecticides over row to control flea beetles (NHE-36) that transmit the wilt bacteria (Cir. 897). One to 6 sprays may be needed, 3 to 5 days apart. Start the day *before* corn comes up.
	Helminthosporium leaf blights	mancozeb, Polyram, or Bravo	Begin when disease first appears. Repeat at 7-day intervals or as required.
	Rust	zineb	Same as above.
ucumber, luskmelon Cantaloupe), umpkin, quash, Vatermelon	Seed rot (RPD915), damping-off, angular and Alternaria leaf spots, Fusarium wilt, gummy stem blight or black rot, anthracnose, scab	captan, or thiram *plus* insecticide	Sow *only* certified, western-grown seed. Watering after planting with captan 50W (2 lb./100 gal. at 1 gal./125 sq. ft., every 5-7 days) controls damping-off. May combine with insecticides (Cir. 897) to control seed-corn maggots (NHE-27) in seedbed. Use 3- to 4-year rotation.
	Bacterial wilt (RPD905)		Use insecticides to control cucumber beetles (NHE-46) that transmit the causal bacteria. Kill beetles *before* they feed (Cir. 897). Applications needed from young seedlings to mature plants. Thorough coverage is essential.
	Anthracnose (RPD920), downy mildew (RPD927), scab (RPD928), blossom blight, leaf spots and blights (RPD918), fruit spots and rots, gummy stem blight or black rot	maneb, mancozeb, zineb, Bravo, Difolatan, Dyrene, or benomyl	Use captan or ziram (2-3 lb./100 gal.) on young plants. Apply at 7- to 10-day intervals from seedling emergence to vining. Start other materials *after* vines begin to run. Repeat at 5- to 10-day intervals to 7-10 days before harvest; keep new growth protected. May combine with insecticides to control cucumber beetles, aphids, vine borer, pickle worm, etc. (Cir. 897).
	Angular leaf spot (RPD919)	fixed copper (2-3 lb. metallic/A.) or soluble copper	Apply at 5- to 7-day intervals in warm, wet weather; or mix with zineb or maneb (2 lb./A.). Begin when plants start to vine or disease *first* appears.
	Mosaics (RPD926)		Use insecticides to control aphids (NHE-47) and beetles (NHE-46) that transmit the viruses (Cir. 897). Kill insects *before* they feed. Control weeds (Cir. 907).
	Powdery mildew (RPD925)	Karathane WD, benomyl (8 oz./100 gal.), Bravo *plus* spreader-sticker	Dust or spray. Thorough coverage essential. Repeat 5-10 days later. Do not apply within 7 days of harvest. Use benomyl alone.
ggplant	Seed rot (RPD915), seed-borne anthracnose, Phomopsis blight (RPD949), and Verticillium wilt (RPD950)	hot water, then thiram or captan	Treat seed just before planting.
	Damping-off (RPD916)	captan	Seedbed or flat spray, 5 gal./100 sq. ft. Repeat at 5- to 7-day intervals.
	Blight (Phomopsis, Alternaria, Cercospora) (RPD949), anthracnose	maneb, zineb, or captan	Start when disease is first evident, *or* when first fruits are half mature. Repeat at 7- to 10-day intervals. *Do not use copper fungicides on eggplant.* May combine with insecticides (Cir. 897).
ettuce, ndive	Seed rot (RPD915), damping-off (RPD916), gray mold (RPD942)	thiram, Botran, ferbam, zineb	Dust seed lightly with captan 75. Then apply Botran as dust or spray just before or just after seeding. For *field use only.*
	Aster yellows (RPD903), white heart		Use insecticides to control leafhoppers that transmit the mycoplasma. Kill leafhoppers *before* they feed (Cir. 897). Applications needed throughout season. Dust or spray weed borders.
	Mosaics (RPD946)		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Sow *only* mosaic-indexed seed. Control weeds in and around plant-growing areas (Cir. 907). Keep new and old beds as far apart as possible.

CONDENSED FUNGICIDE RECOMMENDATIONS (continued)

Vegetable	Diseases	Fungicide	Remarks
	Gray mold (RPD942), downy mildew, other fungus leaf spots, white rust	ferbam, maneb, or zineb	Apply at 5- to 7-day intervals in cool, damp weather. Do n apply within 10 days of harvest. May combine with insecticid to control aphids, leafhoppers, flea beetles, etc. (Cir. 897).
		Botran	Botrytis control. Do not apply within 14 days of harvest.
	Sclerotinia	Botran or ferbam	
Okra	Seed rot (RPD915), damping-off	thiram	Seed treatment. Apply any time.
Onion, Garlic	Smut (RPD933), seed decay (RPD915), damping-off, seed-borne purple blotch	thiram or captan	Apply to seed any time (RPD933). For *onion sets*, use 1 l (100% active) to 20 lb. seed; for *bulb onions*, wet seed wi Methocel sticker then treat with 8 lb. thiram 75 or captan 75 8 lb. seed. For *pickling and green bunching onions*, same as for bu onions; but use half dosage. Control seed- and bulb-feeding i sects (Cir. 897).
	Blast (RPD931), downy mildew, purple blotch, gray mold blight (RPD942), neck rot (RPD930)	maneb, Difolatan, Bravo 6F, Dyrene, mancozeb, or zineb *plus* spreader-sticker	Apply every 5 to 7 days in moist weather. May combine wi insecticides to control thrips, onion maggots, cutworms, e (Cir. 897).
	Yellow dwarf, mosaics		Use insecticides to control aphids (NHE-47) that transmit t viruses Kill aphids *before* they feed (Cir. 897). Keep new a old plantings *as far apart* as possible.
Pea, Lentil	Seed decay (RPD915), damping-off, seed-borne foot rots, Ascochyta and Mycosphaerella blights (RPD945), Fusarium wilts (RPD912), and bacterial blights	Dexon, thiram, captan, or zineb *plus* insecticide	Treat seed any time or buy seed treated with fungicide-insec cide. Sow certified, western-grown seed. Where captan thiram are used, friction may reduce seeding rate; add graph (1 oz./bu.).
	Leaf and stem spots or blights (RPD945)	zineb	Apply weekly in rainy weather where diseases have been seve in past.
	Mosaics (RPD947), streaks, stunt, mottle, wilt		Use insecticides to control aphids (NHE-47) and other inse that transmit the viruses. Kill insects *before* they feed (Cir. 89 Also treat field borders.
	Powdery mildew	lime-sulfur dust (4-6 ratio) 30 lb./A.	Do not apply at air temperature above 80° F. or when plants a in flower. Two applications, a week apart, when mildew f appears, should be sufficient.
Peanut	Seed rot (RPD915), seedling blights	Botran, thiram, Difolatan, or captan	Treat seed anytime. Do not use treated seed for food, feed, or
Potato, Irish	Seed-piece decays (RPD915), and seed-borne Verticillium wilt (RPD950)	captan, maneb, Polyram, zineb, or mancozeb	Apply as dust or dip to cut and uncut tubers. Follow mar facturer's directions. Tubers should be well corked over. Pl in warm (over 50° F.) soil.
	Blackleg (RPD943)	streptomycin	May combine with treatment for seed-piece decays. Use unc B-size, certified seed.
	Early blight (RPD935), late blight (RPD936), and minor leaf spots and blights	maneb, mancozeb, Difolatan, Bravo, Polyram, Dyrene, Du-Ter	Apply at 4- to 10-day intervals. If rainy, shorten interval dry, lengthen. For "finish-up" sprays use fixed copper (3 metallic/A.). May combine with insecticides (Cir. 897).
	Common scab (RPD909), and black scurf (*Rhizoctonia*)	PCNB(various formulations)	May help on *mineral* soils. Work into top 4-6 inches of soil at before planting. Follow manufacturer's directions carefu Dust seed pieces with difolatan or mancozeb.
	Mosaics, leafroll, mottle, purple-top, yellow dwarf, etc.		Use insecticides to control aphids (NHE-47), leafhoppers (NH 22), etc., that transmit the viruses. Kill insects *before* they f (Cir. 897).
Rhubarb	Root and crown rots	fixed copper (3 lb. metallic/A.)	Drench crowns early in spring and after harvest. Plant *only* well-drained soil.
	Leaf and stalk spots, anthracnose	captan, Botran	Avoid applications from 2 weeks before harvest until cuttin completed (greenhouse only). May combine with insectici (Cir. 897).
	Mosaics, ringspots		Use insecticides to control aphids (NHE-47) that transmit viruses. Kill aphids *before* they feed (Cir. 897).
Sweet potato	Black rot (RPD953), foot rot (RPD958), Fusarium wilt (RPD954), scurf (RPD957)	Botran	Seed dip or bed spray.
		thiram (1½ oz./gal.), thiabendazole	Dip disease-free roots or sprouts just before planting. Foll manufacturer's directions. Seedbed disinfestation (Cir. 8 Three to 4-year rotation. Strict sanitation. Do not rinse a treatment.
	Storage rots (RPD952)	Botran (as post-harvest dip or in wash water)	Helps reduce transit and market losses caused by Rhizopus rot and black rot. Fumigate storage houses with formaldehy

CONDENSED FUNGICIDE RECOMMENDATIONS (concluded)

Vegetable	Diseases	Fungicide	Remarks
mato, pper	Seed decay (RPD915), seed-borne bacterial spot (RPD910), speck and canker (RPD962), early blight (RPD908), Septoria blight, anthracnose, Fusarium wilt (RPD929), leaf mold (RPD941)	hot water, then captan, or thiram	Treat seed, buy treated seed, or certified, disease-free transplants (Cir. 912).
	Bacterial spot (RPD910)	fixed copper-streptomycin mixture	Start when seedlings emerge and apply every 5 days. In *field*, use fixed copper (2-3 lb. metallic/A.) plus maneb or mancozeb (2 lb./A.).
	Damping-off (RPD916) and seedling blights, collar rot (RPD908)	captan, ferbam	Dust or spray in seedbed. Apply as plants emerge so spray runs down stems. Repeat every 4 to 7 days until 10 days before transplanting. Follow the manufacturer's directions.
	Septoria blight (RPD908), early blight, anthracnose, late blight (RPD913) and buckeye rot, gray leaf spot, leaf mold (RPD941)	maneb, mancozeb, Polyram. zineb, Difolatan, Dyrene, Bravo benomyl	Apply every 7 to 10 days *after* first fruit clusters form. Five or more sprays may be necessary, depending on weather. Combine with insecticides to control flea beetles, climbing cutworms, hornworms, fruit flies, etc. (Cir. 897). *Soil surface spray of maneb or Difolatan after last cultivation improves anthracnose control.* Tomato leaf mold and Botrytis control.
	Mosaics (RPD917)		Use insecticides to control aphids (NHE-47) and beetles that transmit the viruses. Kill insects *before* they feed (Cir. 897). Control weeds in and around plant-growing area (Cir. 907). Set out certified, virus-free transplants and start with virus-free seed.
	Blossom-end rot (RPD906)	calcium nitrate (4-6 lb./A.)	Application of 4 or more consecutive sprays in the regular schedule may reduce losses. Start when fruits are the size of grapes. Irrigate to maintain uniform soil moisture.
	Cloudy spot (RPD914)		Use insecticides to control stink bugs that produce cloudy spot by feeding punctures (Cir. 897).
eneral diseases that tack most vegetable ops)	Damping-off (RPD916) and seedlings blights; gray mold (RPD942) or Botrytis blight	After planting apply captan, thiram, or zineb (1 T./gal.); ferbam or ziram (2 T./gal.)	Disinfest seedbed soil (Cir. 893), then apply seed treatment (RPD915). Then apply sprays or drenches after planting. Apply *only* if damping-off appears in seedbed and when seedlings need water. (*For crucifers, pepper, peas, beans, tomato, lettuce,* add PCNB to other fungicides to give broad-spectrum control.) Use at least 5 gal. per 1,000 sq. ft. of bed. Repeat at 5- to 7-day intervals when temperature is below 75° F.
	Root knot and other nematodes; Fusarium wilts of various crops (RPD901,904,912,929, 954)	Heat or chemicals may be used. Consult Cir. 893 for names, general precautions, and directions	Disinfest seedbed soil (heat preferred, if available). Follow manufacturer's directions exactly. Fumigants work best in light, loose soils, free of trash, clods, and lumps. Avoid recontamination of treated soil. Best to apply fumigants during the fall that precedes planting. In general, soils must be at least 55° F. at the 6-inch depth with a time lapse of 21-28 days between treating and seeding. Some require gas-tight plastic covers.
	Root and stem or crown rots of various crops (RPD902,911,922,923, 932,948,953)		*Plant resistant varieties when available.*
	Verticillium wilt (RPD950)		

GENERAL SUGGESTIONS ON FUNGICIDE APPLICATION

1. Cover the foliage uniformly. *Ground equipment* — Apply 75 to 125 gallons per acre at approximately 400 pounds per ...re inch of pressure. Lower volumes and/or pressures may provide adequate coverage, but high-volume, high-pressure applica...s provide ideal coverage. Make sure the sprayer is functioning properly. Check the nozzles for cleanliness and wear. Boom, ...ght, accuracy of pressure gauge, agitation, and calibration should also be checked. *Aerial application* — Apply recommended ...ounts of pesticide per acre in 3 to 5 gallons of water. Make sure nozzles are properly aligned and clean, so uniform applica... is achieved. Cover a swath no wider than is reasonable for the aircraft and boom being used. Spray only those fields which ... suitable for aerial application. Avoid fields of irregular shape or topography, particularly if they are bounded by power lines, ...s, or other obstructions.

2. Whenever possible spray when the air is still or when wind velocity is not excessive (less than 10 to 12 m.p.h.).

3. Avoid situations where pesticide drift may cause needless problems.

4. When it is compatible with the product label, use a spray adjuvant (surfactant). Some commonly available surfactants ...: Colloidal Products X77 (liquid, non-ionic) spreader activator; Colloidal Products Multifilm L. (liquid); Colloidal Products ...ay Modifier (liquid, non-ionic) spreader sticker; Millers Nufilm 17 liquid spreader sticker; Millers Nufilm P liquid spreader ...ker; Allied Chemical Plyac (liquid) sticker; Rohm and Haas Triton B — 1956 (liquid, non-ionic) spreader sticker; Triton ...7, spreader-binder; and Du Pont Spreader Sticker (liquid) spreader sticker.

1978 Insect Pest Management Guide

COMMERCIAL VEGETABLE CROPS And GREENHOUSE VEGETABLES

You must be certified as a pesticide applicator to use "restricted use" pesticides. See your county extension adviser for information.

Commercial vegetable gardeners find it impossible to produce vegetables profitably unless they control insects at maximum efficiency and minimum cost. The housewife of today will not accept unsightly wormy vegetables; not only are wormy fruits and vegetables unappetizing but the waste from trimming increases food costs. Thus the commercial vegetable gardener must produce a quality product that is acceptable and safe to the consumer. Careful use of the right insecticides will enable him to do this.

Insect pest management programs, which include the wise selection of cultural, mechanical, biological, and chemical methods, are suggested for the major insect pests of vegetable crops and greenhouses. But, insecticides are still the most efficient means of managing most insects.

This suggested insecticide guide has been prepared for use by Illinois commercial vegetable farmers; it is not for home gardeners, who should use only those insecticides that are extremely safe to handle, apply, and store. Furthermore, the commercial vegetable gardener must use a wider variety of insecticides than the home gardener in order to obtain maximum insect control at the least cost.

In using insecticides, read the label and carefully follow the instructions. Do not exceed maximum rates suggested; observe carefully the interval between application and harvest, and apply only to crops for which use has been approved. Make a record of the product used, the trade name, the percentage content of the insecticide, the dilution, the rate of application per acre, and the dates of application.

Some of the insecticides suggested here can be poisonous to the applicator. In using them, the commercial grower is expected to use precautions to protect himself, his workers, and his family from undue or needless exposure.

In using this guide, always refer to the table on the next page, which lists the limitations and restrictions on use. These limitations apply to the vegetables as human food. If you use any portion of a vegetable for livestock food (tops, stalks, etc.) refer to the label for instructions as to the interval required between application and feeding.

The chemical names used in these tables may be un familiar to you. These names are the common coine chemical names and as such are not capitalized. Trad names are capitalized. In the table of limitations the com mon names are listed first. If the trade name is more com monly used, it is listed in parentheses following th common name. Throughout the tables of suggestions, how ever, the common name is used if there is one. In case o question, refer to the table of limitations.

These suggestions are subject to change without notifi cation during the growing season.

Requested label clearances for a few uses of insecti cides, carriers, and solvents are uncertain for 1978, sinc many requests have not been officially cleared. Anticipatin needed changes in labeling, we began modifying these sug gested uses a few years ago. Be sure to check with you county extension adviser if you are in doubt about th insecticide you plan to use. We will make announcement of label changes through the newsletters and news medi to keep you up to date.

Insecticides are being classified for *general use* or *re stricted use* by the U.S. Environmental Protection Agenc A person wishing to use an insecticide classified for re stricted use must be certified as a private or commerci pesticide applicator by the Illinois Department of Agr culture. Contact your county extension adviser in agricu ture for details on this program. Only a few insecticide have been classified at this time. More will be classifie later. Insecticides bearing a restricted-use classification a identified by an asterisk (*) in this circular.

Suggestions for use of insecticides effective from practical standpoint are based on available data. Soil te tures, pH of the soil, rainfall, slope of the field, win velocity at planting, method and accuracy of applicatio and other unpredictable factors affect efficiency.

This publication was prepared by entomologists of t University of Illinois College of Agriculture and the Il nois Natural History Survey.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVI
In cooperation with ILLINOIS NATURAL HISTORY SURVEY CIRCULAR 897 Urbana, Illinois, December, 197

LIMITATIONS FOR FIELD VEGETABLES IN DAYS BETWEEN APPLICATION AND HARVEST AND OTHER RESTRICTIONS ON USE OF INSECTICIDES IN ILLINOIS

(Blank spaces indicate the material is not suggested for the specific use in Illinois)

Insecticide	Beans	Peas	Broccoli	Brussels sprouts	Cabbage	Cauliflower	Horseradish[1]	Radish[1]	Turnip[1]	Onions	Eggplant	Peppers	Tomatoes
acephate (Orthene)	...	...	...	...	...	...	...	...	...	...	...	7	...
azinphosmethyl (Guthion)[2]	...	...	15	7	21	15	...	...	...	...	...	...	...
Bacillus thuringiensis[3]	...	...	0	0	0	0	...	...	...	...	...	...	0
carbaryl (Sevin)	0	...	3	3	3	3	3	3	3, 14A	...	0	0	0
carbofuran (Furadan)	...	...	...	...	...	...	...	...	...	...	...	21B	...
Dasanit	...	...	...	...	...	...	...	...	...	C, D	...	...	...
demeton (Systox)	...	...	...	...	...	...	...	...	...	...	...	3	...
diazinon	...	...	5	...	7	5	...	10	10	10	...	...	1
dicofol (Kelthane)	7E	...	...	...	...	...	...	...	...	...	2	2	2
dimethoate (Cygon)	0E	0E	7	...	3	7	...	...	14	...	...	0	7
Dyfonate	...	...	C	...	C	C	...	...	...	...	...	...	...
ethion	...	...	...	...	...	...	...	...	...	C	...	...	...
malathion	1	...	3	7	7	7	7	7	3	3	3	3	1
*methomyl (Lannate)	1	1, 5A	3	3	1	3	...	...	...	...	...	10	2
mevinphos (Phosdrin)[2]	...	...	1	3	1	3	...	...	3	...	...	...	...
Monitor	...	...	21	21	35	28	...	...	...	...	...	...	...
naled (Dibrom)	...	...	1	1	1	1	...	...	4	...	...	...	...
oxydemetonmethyl (Meta-Systox R)	...	...	...	...	...	...	...	...	...	...	7F	0B	...
*parathion[2]	7	...	7	7	10	7	...	15	10	...	15	15	10
phorate (Thimet)[2]	C	...	...	...	...	...	...	...	...	...	...	...	...
rotenone	...	...	...	...	...	...	...	...	...	...	1	1	1
trichlorfon (Dylox)	...	...	...	21	21	21	...	...	28E	...	...	21	21

Insecticide	Potatoes[1]	Collards	Kale	Lettuce	Spinach	Swiss chard	Sweet corn	Cucumbers[4]	Melons[4]	Pumpkins[4]	Squash[4] Winter	Squash[4] Summer
Bacillus thuringiensis[3]	...	0	0	0	0	...	...	...	...	...	...	...
carbaryl (Sevin)	0	14	14	14	14	14	0	0	0	0	0	0
diazinon	...	10	10	10	10	12	C	7	3	...	3	7
dicofol (Kelthane)	...	...	...	...	...	...	...	2	2	2	2	2
dimethoate (Cygon)	0	14	14	14	14	14	...	...	3	...	...	...
Dyfonate	...	...	...	...	...	...	C	...	...	...	...	...
malathion	0	7	7	14	7	7	5	1	1	3	1	1
*methomyl (Lannate)	14	...	...	10	7	...	0, 3A	3	3	...	...	...
*mevinphos (Phosdrin)[2]	...	3	3	2	4	...	...	...	...	...	...	...
Mocap	...	...	...	...	...	...	C	...	...	...	...	...
naled (Dibrom)	...	4	4	1	1	1	...	...	...	...	...	...
*parathion[2]	5	10	10	21	14	21	12	15	7	10	15	15
phorate (Thimet)[2]	C	...	...	...	...	...	C	...	...	...	...	...
rotenone	...	1	1	1	1	1	...	...	...	...	...	...
trichlorfon (Dylox)	...	28G	21	28G	...	...	...	...	...	3F	...	...

* Use restricted to certified applicators only.

[1] Root crops such as radishes, turnips, carrots, horseradish, potatoes, and sugar beets should not be grown in soil where aldrin, dieldrin, or heptachlor was applied as a soil insecticide the preceding year.

[2] Use only by professional applicators or commercial gardeners.

[3] Trade names are Biotrol, Dipel, and Thuricide.

[4] Only apply insecticide late in the day after blossoms have closed to reduce bee kill.

A. If tops or stover is to be used as feed.
B. Not more than twice per season.
C. Soil applications at planting time only.
D. Do not use on green onion crop.
E. Do not use tops for feed or food.
F. Not more than three times per season.
G. Not after edible portions or heads begin to form.

REENTRY INTERVALS FOR WORKER PROTECTION

Insecticide	Hours
azinphosmethyl (Guthion)	24
demeton (Systox)	48
ethion	24
parathion	48

Workers must wear protective clothing if they enter treated fields before time intervals at right. They must also wear protective clothing for all other insecticides applied if spray has not dried or dust has not settled.

CABBAGE AND RELATED COLE CROPS[1]

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Cabbage maggot[2] (NHE-44)	All season	diazinon Dyfonate	3 2	Broadcast	Disk in just before planting. Use only cabbage, cauliflower, and broccoli.
		diazinon granules	1	Furrow	At time of planting; on turnips a drenching spray of 1 lb. diazinon should applied 30 days following treatment.
		*azinphosmethyl diazinon	3 oz. W.P. or 2 oz. E.C. per 50 gal. transplant water 4 oz. per 50 gal. transplant water		6 fluid oz. transplant water per plant
Aphid (NHE-47) Thrips (NHE-48)	All season	*azinphosmethyl dimethoate malathion *mevinphos *parathion	¾ 0.3 1 ¼ 0.4	Foliage	When aphids appear, but before leaves begin to curl.
Diamond-back moth larva; imported cabbage worm; cabbage looper (NHE-45)	All season	*Bacillus thuringiensis*[3] *methomyl Monitor	See rates on label 0.45-0.9 1	Foliage	When small worms first appear, and about every 5 to 7 days thereafter. Thorough spray coverage of foliage is important.
Cutworm	At planting	trichlorfon	1	Soil	At planting, at base of plant or as needed when damage first occurs.
Flea beetle and leafhopper	All season	carbaryl	1½	Foliage	As needed.

* Use restricted to certified applicators only.
[1] Root crops such as radishes, turnips, carrots, potatoes, and sugar beets should not be grown in soil where aldrin, dieldrin, or heptachlor was applied as a soil insecticide the preceding year.
[2] Maggots are resistant to diazinon in some areas of Illinois.
[3] No time limitations.
E.C. = emulsion concentrate; W.P. = wettable powder.

COLLARDS, KALE, LETTUCE, SPINACH, SWISS CHARD

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Aphid (NHE-47)	All season	diazinon dimethoate *mevinphos naled *parathion	½ 0.3 ¼ 1 0.4	Foliage	As needed.
Cutworm	On seedling plants	trichlorfon	1	Base of plant and soil	When first damage appears.
Leafhopper	All season	carbaryl dimethoate malathion	1½ 0.3 1	Foliage	When first leafhoppers appear and as needed.
Caterpillar (NHE-45)	All season	*Bacillus thuringiensis*[1] naled	See rates on label 1	Foliage	When small worms first appear and every 5 to 7 days thereafter.
Leaf miner	All season	diazinon dimethoate *parathion	½ 0.3 0.4	Foliage	When first miners are observed.
Flea beetle	All season	carbaryl rotenone	1 ¼	Foliage	As needed.

* Use restricted to certified applicators only.
[1] No time limitations.

BEANS

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Seed maggot (NHE-27)	All season	diazinon 50% W.P.[1]	3/5 oz./bu.	Seed	Treat seed no longer than 3 months before planting.
		Lorsban 25% W.P.[1]	2 oz./bu.	Seed	
		phorate granules	1½	Soilband	Place on either or both sides of row at planting but not in contact with seed.
Bean leaf beetle (NHE-67)	Early and late season	carbaryl	1	Foliage	When feeding first appears and weekly for 2 or 3 applications as needed.
		malathion	1		
Leafhopper (NHE-22) and plant bug (NHE-68)	All season	carbaryl	1	Foliage	Before plants become yellow and stunted. Repeat applications at weekly intervals as necessary.
		dimethoate	0.3		
		malathion	1		
		*methomyl	0.45		
		phorate granules	1½	Soilband	As for seed maggot.
Mexican bean beetle	Midseason and late season	carbaryl	½	Foliage	When occasional leaves show lacework feeding.
		malathion	1		
		phorate granules	1½	Soilband	As for seed maggot.
Aphid (NHE-47)	All season	dimethoate	0.3	Foliage	Usually applied when a few aphids can be found on each plant, but before leaves begin to curl and deform.
		malathion	1		
		phorate granules	1½	Soilband	As for seed maggot.
Blister beetle (NHE-72)	Midseason and late season	carbaryl	1½	Foliage	As needed.
Corn earworm (NHE-33) Corn borer	Late season	carbaryl	1½	Foliage	As needed, but usually after September 1. Worms may be present before bloom.
		*methomyl	0.45		
		*parathion	½		
Mites	Midseason and late season	dicofol	0.4	Foliage	As needed, but especially during drouthy periods particularly if carbaryl has been used on crops.
		dimethoate	0.3		
		malathion	1		
		phorate granules	1½	Soilband	As for seed maggot.

* Use restricted to certified applicators only.
[1] No restrictions when used as recommended.

CUCUMBERS AND OTHER VINE CROPS[1]

Insect	Time of attack	Insecticide[2]	Lb. of active ingredient per acre	Placement	Timing of application[2]
Striped and spotted cucumber beetles (NHE-46)	Seedling to mature plants	carbaryl	1	Foliage	When beetles first appear; as often as necessary thereafter.
		*parathion	½		
Aphid (NHE-47)	All season	diazinon	½	Foliage	When aphids become noticeable.
		dimethoate[3]	0.3		
		malathion	1		
		*parathion	½		
Squash bug (NHE-51)	All season	*parathion	½	Foliage	Do not apply until first eggs are found hatching (about June 15 to July 15).
		trichlorfon[4]	1		
Leafhopper	July-August	malathion	1	Foliage	As needed.
		dimethoate[3]	0.3		
Squash vine borer	June-September	carbaryl	1	Base of stem for 3 ft.	Weekly applications when vines begin to run—usually 5 applications.
Pickle worm	August-September	carbaryl	1	Foliage	Weekly applications, beginning in late August.
Mites	July-September	dicofol	½	Foliage	As needed.
		malathion	1		
		*parathion	½		
Cutworm (NHE-77)	April-June	carbaryl	2	Base of plants	As needed.

* Use restricted to certified applicators only.
[1] Pumpkins should not be grown on soil that has been treated with aldrin, dieldrin, or heptachlor the preceding year.
[2] Spray vine crops with insecticide only late in the day after blossoms have closed to reduce bee kill.
[3] Do not use dimethoate on cucumbers.
[4] Pumpkin is the only vine crop for which trichlorfon should be used for squash bug control. Apply only once per season.

TOMATOES AND EGGPLANT

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Cutworm (NHE-77)	Early and midseason	carbaryl trichlorfon	2 1	Base of plants or foliage	As needed.
Flea beetle	May-June	carbaryl rotenone	2 0.2-0.4	Foliage	Apply every week as long as needed.
Aphid (NHE-47)	May-July	diazinon dimethoate[1] malathion *parathion	¼ 0.3 1 0.4	Foliage	As needed, but before leaves curl.
Cabbage looper	July-September	*Bacillus thuringiensis* *methomyl	See rates on label 0.45-0.9	Foliage	When loopers are present.
Corn earworm Corn borer	July-September; occasionally in June	carbaryl *methomyl[1]	2 0.45-0.9	Foliage	Add to weekly applications of fungi sprays beginning at first fruit set. spraying is infrequent, use 6 lb. of to phene.
Hornworm	July-September	carbaryl trichlorfon	2 1	Foliage	When first small worms appear.
Mites	July-September	carbophenothion dicofol malathion *parathion	1 ½ 1 0.4	Foliage	As needed.
Russet mite	July-September	*parathion sulfur dust[2] sulfur spray[2]	0.4 10 10	Foliage	As needed.
Blister beetle (NHE-72)	June-September	carbaryl *parathion	1½ ¼	Foliage	As needed.
Fruit fly and picnic beetle	August-October	diazinon spray diazinon granules	½ 1	Foliage	When flies or beetles first appear.
		pyrethrin dust[2]	1	Foliage	Apply to hamper immediately after s filled.

* Use restricted to certified applicators only.
[1] Use cleared only on tomatoes. [2] No limitations on use.

PEPPERS

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Aphid (NHE-47)	May-July	dimethoate demeton *methomyl oxydemetonmethyl acephate	0.3 ⅜ 0.45 ½ ½	Foliage	Only when aphids are present. Add to borer spray when it is being used.
Corn borer	Late season	carbaryl acephate	2 1	Foliage and fruit	When fruit is present on plant. Apply every 5 days when borers are present.
		carbofuran	2-3	Soilband to transplant	Make 2 applications; first, 3 weeks after transplant, second, 5 weeks later.

* Use restricted to certified applicators only.

ASPARAGUS

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Asparagus beetle (NHE-49)	Early and mid-season on spears and ferns	carbaryl[1] malathion[1]	1½ 1	Spears and ferns	As needed, not more often than every 3 days.
		rotenone[1]	0.2-0.4	Spears	As needed.

[1] One-day restriction between last application and harvest.

SWEET CORN

[illegible]ect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
S[illegible] insects (NHE-26, 27, 43)	April-August	diazinon Dyfonate Mocap phorate	1 1 1 1	Row	Apply on soil surface behind planter shoe and ahead of press wheel.
C[illegible]tworm (NHE-38)	April-June	carbaryl[1] carbaryl bait	2-3 1	Base of plants	When first damage appears.
F[illegible]a beetle (NHE-36)	April-July	carbaryl[1]	1½	Foliage	As necessary.
J[illegible]anese beetle (NHE-32)	July-September	carbaryl[1]	1	Ear zone	As necessary.
C[illegible]rn borer	June-September	carbaryl[1] *methomyl	2 0.45	Foliage	Make first application when tassel ratio is 30 to 40. Repeat every 4 to 5 days as long as field has 20 or more unhatched egg masses per 100 plants.
C[illegible]rn earworm[2] (NHE-33)	June-September	carbaryl[1] *methomyl	2 0.45	Ear zone	Market corn: At first silk and every 2 to 3 days for 5 to 8 applications. On very early or late planted corn, treatment may be necessary before silking when eggs are being laid on stalks and flag leaves. Canning corn: At 30 to 50% silk and every 3 days thereafter until corn is within 8 to 12 days of harvest.
S[illegible]p beetle (NHE-10) I[illegible]nic beetle	July-September	carbaryl[1] diazinon malathion *parathion	2 1 1 ½	Foliage	When adults first appear in field; usually between pollen-shedding and silk-drying.
C[illegible]rn leaf aphid (NHE-29)	July-September	malathion *parathion	1 ½	Foliage	As needed to produce attractive ears for fresh market.
[illegible]ll armyworm	July-September	*methomyl *parathion	0.45 ½	Foliage	Apply to ear zone when whorl feeding is evident.

* Use restricted to certified applicators only.
[1] During pollen shed, apply carbaryl as late in the day as possible (preferably after 4 p.m.) to reduce bee kill.
[2] Addition of 0.5 to 0.75 pound of parathion or 0.25 to 0.45 pound of methomyl to carbaryl improves earworm control.

ONIONS

[illegible]sect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
[illegible]nion maggot (NHE-50)	All season	diazinon W.P ethion W.P.	½-1 for 40-50 lb. of seed 1 for 40-50 lb. of seed	Seed	Seed treatment for set onions only. Use lighter dosage of diazinon on sandy, highly mineral soils.
		Dasanit granules diazinon granules Dyfonate ethion granules	1 ½-1 1 ½-2	Furrow	Use 1 lb. active ingredient per acre for rows 12″ apart; ¾ lb. for rows 18″ apart; ½ lb. for rows 24″ apart. Up to twice these amounts are needed for ethion on muck soils. Do not use Dasanit or Dyfonate on green onions.
		diazinon	2	Broadcast	Preplanting; disk into upper 1 to 2 inches of soil. Supplement with foliage spray below.
		diazinon malathion	⅓ 1	Foliage	Supplemental to soil treatment. Make first application when first adult flies are seen; make another 1 week later. From then on only as necessary.
[illegible]hrips (NHE-48)	Midseason and late season	diazinon malathion	½ 1	Foliage	When injury first appears and every 10 days as necessary.

POTATOES[1]

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Flea beetle	May-July	carbaryl *methomyl	1 0.45	Foliage	When first damage appears on lea and repeat as needed.
Colorado potato beetle	May-July	carbaryl	1	Foliage	As needed.
Potato leafhopper (NHE-22)	May-July	carbaryl dimethoate *methomyl	1 0.3 0.45	Foliage	Weekly applications when leafhop first appear.
		phorate granules	2-3	Soilband	Place on either or both sides of ro planting but not in contact with s Use lower rate on sandy soils and hea rate on heavy soils. Do not use on n soils.
Aphid (NHE-47)	All season	dimethoate malathion *methomyl *parathion	0.3 1 0.45 ¼	Foliage	As needed.
		phorate granules	2-3	Soilband	As for leafhoppers.
Blister beetle (NHE-72)	All season	carbaryl	1½	Foliage	As needed.
Wireworm (NHE-43) White grub (NHE-23)	All season	phorate granules	2-3	Soil	Preplanting, disk in; or use as soil at planting.
Grasshopper (NHE-74)	July-September	carbaryl	¾	Foliage	As needed, control in fence rows, r sides, ditch banks, etc., before migra

* Use restricted to certified applicators only.
[1] Potatoes should not be grown in soil where aldrin, dieldrin, or heptachlor was applied as a soil insecticide the preceding year.

PEAS

Insect	Time of attack	Insecticide	Lb. of active ingredient per acre	Placement	Timing of application
Caterpillars including loopers	June	*methomyl	½-1	Foliage	Before harvest if worms are present.
Aphids	May-June	dimethoate	⅓	Foliage	As needed.

* Use restricted to certified applicators only.

Limitations for Greenhouse Tomatoes

Insecticide	Tomatoes
endosulfan (Thiodan)	15 hours
malathion	15 hours
metaldehyde	As bait applied only to soil
naled (Dibrom)	1 day
*parathion[1]	10 days

* Use restricted to certified applicators only.
[1] Do not use aerosols that contain parathion, tepp, or the propellant methyl chloride in greenhouses connected to living quarters.

GREENHOUSE TOMATOES

ect	Insecticide[1]	Dosage and formulation	Application
Aiid Witefly	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	naled vapor	5 oz. of 4% E.C. per 50,000 cu. ft.	Apply on steampipes.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
Nalybug Sider mite Rsset mite Tip		Use malathion or parathion aerosol as suggested for aphid and whitefly.	
Anyworm Cbage looper Ctworm Tnato fruitworm	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
Sg	metaldehyde	Commercially prepared bait or spray	To mulch on soil surface. Do not contaminate edible parts.

* Use restricted to certified applicators only.
[1] See page 7 for limitations between application and harvest.

FOR ADDITONAL INFORMATION

Obtain the following circulars on insect control from tl Office of Agricultural Publications, 123 Mumford Hll, Urbana, Illinois 61801.

Crcular 899, Insect Pest Management Guide — Field and Forage Crops

Crcular 900, Insect Pest Management Guide — Home, Yard, and Garden

Crcular 1076, Turfgrass Pest Control

Leaflets describing the life history, biology, and habits of some of the insects mentioned can be obtained from the offices of county extension advisers or by writing to Entomology Extension, 169 Natural Resources Building, Urbana, Illinois 61801. These are indicated by an NHE number in the tables.

FOR YOUR PROTECTION

Always handle insecticides with respect. The persons ost likely to suffer ill effects from insecticides are the aplicator and his family. Accidents and careless, needless cerexposure can be avoided. Here are a few easy rules tat if followed will prevent most insecticide accidents:

1. Wear rubber gloves when handling insecticide contrates.
2. Do not smoke while handling or using insecticides.
3. Keep your face turned to one side when opening insticide containers.
4. Leave unused insecticides in their original containers with the labels on them.
5. Store insecticides out of reach of children, irresponsble persons, or animals; store preferably in a locked binet.
6. Triple-rinse and bury or burn all empty insecticide ntainers or take to an approved sanitary landfill.
7. Do not put the water-supply hose directly into the pray tank.
8. Do not blow out clogged nozzles or spray lines with your mouth.
9. Wash with soap and water exposed parts of body and clothes contaminated with insecticide.
10. Do not leave puddles of spray on impervious surfaces.
11. Do not apply to fish-bearing or other water supplies.
12. Do not apply insecticides, except in an emergency, to areas with abundant wildlife or to blossoming crops visited by bees. Avoid drift onto blossoming crops or onto bee hives.
13. Do not apply insecticides near dug wells or cisterns.
14. Do not spray when weather conditions favor drift.
15. Observe all precautions listed on the label.
16. To avoid bee kill, apply insecticides after bee activity has been completed for the day; use the least toxic materials. *Warn beekeepers that you are applying insecticides.*

sued in furtherance of Cooperative Extension Work, Acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. JOHN B. CLAAR, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign. The Illinois Cooperative Extension Service provides equal opportunities in programs and employment.

Proceedings

1979 Illinois Vegetable Growers Schools with grower suggestions

University of Illinois at Urbana-Champaign
Agricultural Experiment Station
Cooperative Extension Service, College of Agriculture

January, 1979
Department of Horticulture Series 12

FOREWORD

This Proceedings records information presented at 1979 Illinois Vegetable chools, reports research from the University of Illinois, and provides extenion recommendations for vegetable growers. The update reports along with urrent recommendations for insect, disease, and weed control, make this booket a valuable reference manual for year-round use by all market growers hroughout Illinois.

You are invited to attend the following schools and conferences in 1979.

January 22-25	Educational and annual meeting of the Illinois Vegetable Growers Association - *Ramada Inn, Champaign*
February 13	Southern Illinois Vegetable School - *Cobden*
February 14-15	Southwest Illinois Vegetable School - *Holiday Inn, Collinsville* - 8:30 a.m. - 4:00 p.m. - February 14 8:30 a.m. - noon - February 15
February 16	Central Illinois Vegetable School - *Farm Bureau Auditorium, Springfield* - 1:00 - 4:00 p.m.
February 20	Northeast Illinois Vegetable School - *American Legion Hall, Peotone* - 9:00 a.m. - 4:00 p.m.
February 21	Northeast Illinois Vegetable School - *Kane County Extension Center, St. Charles* - 9:00 a.m. - 4:00 p.m.
March 8	Northcentral Illinois Vegetable School - *Erics Restaurant, Rochelle* - 9:00 a.m. - 4:00 p.m.
March 12-13	Illinois Roadside Market Conference - *Holiday Inn, Collinsville* - 6:00 p.m. - 9:00 p.m. - March 12 9:00 a.m. - 4:00 p.m. - March 13
March 14-15	Illinois Community-Farm Market Conference - *Sheraton O'Hare, Rosemont* - 6:00 p.m. - 9:00 p.m. - March 14 8:30 a.m. - 3:00 p.m. - March 15
August 30	Field Day Tour - *Illinois River Valley Sand Field, Kilbourne* - 6:30 p.m.

Thanks and appreciation are due to commercial seed companies, agricultural chemical manufacturers and suppliers, the Illinois Vegetable Growers Association, and commercial growers who support and participate in our extension and research programs.

Additional copies of this Proceedings are available at cost of $3 each. Make checks payable to the University of Illinois and send your order to the Department of Horticultre, 124 Mumford Hall, Urbana, IL 61801.

JWCourter

J. W. Courter
Editor of Proceedings and
Professor of Horticulture

This publication was compiled and edited
by J. W. Courter, Professor of Horticulture

URBANA, ILLINOIS JANUARY, 1979

Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914 in cooperation with the U. S. Department of Agriculture. John B. Claar, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign.

CONTENTS

Research Reports

Extension Recommendations

NUTRITIONAL IMPORTANCE OF FRESH FRUITS AND VEGETABLES

Mary S. Goddard and Susan E. Gebhardt

Fruits and vegetables play a very important role in human nutrition. Many are excellent sources of Vitamins A and C, supply other nutrients to a lesser degree and at the same time are usually very low in calories. In addition, consumption of fruits and vegetables will satisfy many of the objectives set down in the dietary goals. For example, they are valuable in low sodium diets, weight control diets, and diets which require an increase in fiber.

Consumer preferences in purchasing fruits and vegetables indicate that the fresh produce is more desirable than processed and must be of high quality. Appearance is most often cited as an indication of quality by the consumer. Because there is a correlation between the retention of nutrients and the sensory qualities of fresh fruits and vegetables, it is beneficial for growers, wholesalers, retailers and consumers that this high quality be maintained. Although substantial information is available on the nutrient content of fruits and vegetables, additional information is needed on the variables that affect the nutrient content of fruits and vegetables from harvest to table.

Nutrient content of fruits and vegetables. The concept of the Basic Four Food Groups has been used for two decades as a guide for choosing a balanced, nutritious diet. It advises choosing a specified number of servings each day from the meat group, the dairy group, the bread and cereal group, and the fruit and vegetable group to assure a balanced diet. This concept indicates that the major contributions of the fruit and vegetable group are vitamins A and C. The basic four does not, however, address the importance of fruits and vegetables as valuable sources of other essential nutrients that, although less predominant in amount than vitamins A and C, are nevertheless important.

Figure 1 shows the percentages of selected nutrients contributed by fruits and vegetables as a group according to the average amount consumed per person per year (10). As a group they supply over 90 percent of the vitamin C and almost half of the vitamin A. They also supply important amounts of vitamin B_6, thiamin, niacin, magnesium, and iron and are very low in calories.

The concept of nutrition labeling is a new tool for making nutrition information available to the American consumer. It is a voluntary program but becomes mandatory for packaged products that make a nutrition claim or contain added nutrients. Complex regulations govern the nutrition label format, the listing of nutrient content, and nutrient analyses. Fresh fruits and vegetables are exempt from nutrition labeling at the present time. Some of the problems that would be involved in labeling fresh fruits and vegetables are the sources of natural variability including cultural practices, growing conditions, cultivar, handling procedures and the fact that after harvest fresh produce continues to metabolize and nutrient content changes.

Consumer and Food Economics Institute, Science and Education Administration, U. S. Department of Agriculture, Hyattsville, MD 20782.

The nutrients required for nutrition labeling are expressed as a percent of the U. S. Recommended Daily Allowances (U.S. RDA) per serving. The U.S. RDA's were established by the Food and Drug Administration. They are based on the Recommended Dietary Allowances established by the Food and Nutrition Board of the National Research Council - National Academy of Sciences (5) as the levels of intake or nutrients that adequately meet the nutritional needs of most healthy individuals.

The contribution of nutrients by fruits and vegetables can be illustrated by several examples that are grown extensively in Illinois. From Agriculture Handbook #456, Nutritive Value of American Foods in Common Units (1), we calculated percentages of U.S. RDA for the vitamins and minerals required for nutrition labeling (Tables 1 and 2).

One quarter of a cantaloupe contributes 92 percent of the U.S. RDA for vitamin A and 75 percent of vitamin C (Table 1). One peach contributes 35 percent of the U.S. RDA for vitamin A and 15 percent of vitamin C. Strawberries are high in vitamin C; one cup has 147 percent of the U.S. RDA. An apple has 10 percent of the U.S. RDA for vitamin C but less than 5 percent of any of the other vitamins or minerals. These fruits provide about 50 calories per serving except for apples which are slightly higher.

TABLE 1. CONTRIBUTION OF VITAMINS AND MINERALS BY SELECTED FRUITS[1]

	Apple	Cantaloupe	Peach	Strawberries
Weight[2]	1 = 38 g (4.9 oz)	1/4 = 136 g (4.8 oz)	1 = 133 g (4.7 oz)	1 cup = 149 g (5.3 oz)
Calories	80	41	51	55
	<------------	(% U.S. RDA)	------------	------------>
Vitamin A	2	92	35	2
Vitamin C	10	75	15	147
Thiamin	3	4	2	3
Riboflavin	2	2	4	6
Niacin	1	4	6	4
Calcium	1	2	1	3
Iron	2	3	4	8

[1]Adams, C. F., 1975.
[2]Notice that weights are for household measures and differ from item to item.

Among vegetables green pepper is especially high in vitamin C, and one pepper contributes 350 percent of the U.S. RDA (Table 2). Cabbage is also high in vitamin C, and one cup, shredded, supplies 118 percent of the U.S. RDA. One tomato contributes 47 percent of the U.S. RDA for vitamin C and 22 percent of that for Vitamin A. One-half of an acorn squash has 44 percent of the U.S. RDA for vitamin A and 33 percent of that for vitamin C. Except for the squash, these vegetables provide less than 50 calories per serving (Table 2). These examples of the vitamins and minerals reported for nutrition labeling show that the major contributions of both fruits and vegetables are vitamins A and C, plus small amounts of the other vitamins and minerals.

TABLE 2. CONTRIBUTION OF VITAMINS AND MINERALS BY SELECTED VEGETABLES[1]

	Shredded cabbage	Green pepper	Acorn squash	Tomato
Weight[2]	1 cup = 150 g (5.3 oz)	1 = 164 g (5.8 oz)	1/2 = 156 g (5.5 oz)	1 = 135 g (4.8 oz)
Calories	36	36	86	27
	<---	(% U.S. RDA)	---	--->
Vitamin A	4	14	44	22
Vitamin C	118	350	33	47
Thiamin	5	9	5	5
Riboflavin	5	8	12	3
Niacin	2	4	6	4
Calcium	7	2	6	2
Iron	3	6	9	3

[1]Adams, C. F., 1975.
[2]Notice that weights are for household measures and differ from item to item.

Consideration of only those nutrients required for nutrition labeling or even the Basic Four concept does not cover the total beneficial contribution of fruits and vegetables to the diet. The other roles that fruits and vegetables can play in improving the American diet should also be considered.

The Senate Select Committee on Nutrition and Human Needs has published the Dietary Goals (13) as a guide for improving the diet of the U.S. population. These goals are:

1) avoid overweight;
2) increase consumption of complex carbohydrates and "naturally occurring" sugars;
3) reduce consumption of refined and processed sugars;
4) reduce overall fat consumption;
5) reduce saturated fat consumption;
6) reduce cholesterol consumption;
7) limit intake of sodium by reducing intake of salt.

One of the ways suggested to accomplish these changes is to "increase consumption of fruits and vegetables and grains." These foods are:

1) low in calories;
2,3) contain only "naturally occurring sugars" and complex carbohydrates and no refined sugars;
4,5) contain very little fat;
6) contain no cholesterol;
7) are low in sodium.

The mineral elements, sodium and potassium, are of particular importance in certain physiological conditions. Physicians recommend that sodium intake be reduced in certain disease conditions, including hypertension and kidney disorders. Fruits and vegetables are naturally very low in sodium content and are therefore valuable in sodium-controlled diets; with the exception of beets, carrots, celery, and spinach which contain moderate amounts of soidum.

The potassium requirement of healthy adults is about 2.5 g per day. There is no RDA for potassium at present, but this mineral element is widely distributed in foods and under normal conditions a deficiency is very unlikely. However, for persons with some physical conditions, a dietary increase in potassium is advised. In the treatment of hypertension, for example, the use of certain medications requires an increase in potassium intake. Fruits and vegetables are important sources of potassium. One cup of raw, whole strawberries supplies 244 mg and one cup of baked butternut squash, 1,248 mg (Table 3) (1). An increase in the consumption of fruits and vegetables, particularly those that are high in nutrient content, would be extremely beneficial in diets that require a reduction in calories and sodium and an increase in vitamins and minerals.

TABLE 3. POTASSIUM CONTENT OF SELECTED FRUITS AND VEGETABLES[1]

Food	Unit of measure	Weight	Measure	Potassium
		(g)	(oz)	(mg)
Peach, raw	1 medium	175	6.2	308
Strawberries, raw, whole	1 cup	149	5.3	244
Corn, cut, boiled	1 cup	165	5.8	272
Squash, butternut, baked	1 cup	205	7.2	1,248

[1]Adams, C. F., 1975.

Fruits and vegetables are excellent sources of dietary fiber. Some evidence shows that dietary fiber might have a beneficial physiological significance. However, methods of analysis and dietary recommendations for fiber are still being established.

Factors that affect the nutrient content of fruits and vegetables. Variation in cultivars planted and growing and handling techniques affect the nutrient content of fruits and vegetables. Sweet potatoes of the Centennial cultivar grown in five locations varied substantially in their contents of calcium and provitamin A carotenoid. Ranges were from 7 to 24 mg/100 g for calcium and from 3,300 to 4,250 I.U./100 g for vitamin A (Table 4) (8). Likewise, sweet potatoes of different cultivars grown in one location varied substantially in their nutrient content.

TABLE 4. CAROTENE AND CALCIUM CONTENTS OF CENTENNIAL SWEET POTATOES BY GROWING LOCATION[1]

State	Carotene (IU/100 g)	Calcium (mg/100 g)
North Carolina	3,695	7
Arkansas	4,250	22
Tennessee	3,330	14
Mississippi	3,625	24
Louisiana	4,250	16

[1]Southern Regional Technical Committee, 1978.

The vitamin C content of different cultivars of apples also illustrates the variation of nutrients among cultivars. The values ranged from 2 to 19 mg/100 g among the 11 cultivars of apples (Table 5) (9).

TABLE 5. VITAMIN C CONTENT OF SEVERAL APPLE CULTIVARS[1]

	mg/100g
Wegener	19
Northern Spy	16
Rome Beauty	11
Jubilee	10
Golden Delicious	10
Winesap	9
Jonathan	7
Red Delicious	6
Stayman	6
Spartan	3
McIntosh	2

[1]Strachen, C. C. *et al*, 1951

Tomatoes provide a good source of vitamin C. The level of vitamin C in tomatoes increases during the ripening process and then decreases as they become overripe. The level of vitamin C in the ripened tomato also varies according to the degree of ripeness at the time of harvest. This is shown in Table 6 (6).

TABLE 6. VITAMIN C IN TABLE RIPE TOMATOES PICKED AT THE TABLE RIPE (TR), LIGHT PINK (LP), AND MATURE GREEN (MG) STAGES[1]

Picking stages	Post-harvest treatment	Vitamin C (mg/100g)
TR	none	19.9
LP	ripened @ 68° F.	18.7
LP	held 7 days @ 54° --->	18.1
MG	ripened @ 68° F.	12.3
MG	held 7 days @ 54° --->	15.5

[1]Kader, A. A., *et al*, 1978.

Handling conditions for fresh produce during the time between harvest and purchase by the consumer can affect the vitamin content. Postharvest storage conditions affect the retention of nutrients, particularly vitamin C. Percent retention of vitamin C in spinach stored 9 days is shown in Table 7 (2). Retention of vitamin C was highest in spinach stored in controlled atmosphere at 45 degrees F. Ezell and Wilcox (4) showed that leafy vegetables, such as spinach, were more susceptible to the loss of vitamin C associated with wilting than were green beans. Wilting was also associated with loss of vitamin A but to a lesser degree (3). In all vegetables analyzed, both vitamins were more readily affected by storage temperature than by wilting.

TABLE 7. PERCENT RETENTION OF VITAMIN C IN SPINACH STORED 9 DAYS IN AIR OR CONTROLLED ATMOSPHERE (CA) AT 34° AND 45° F.[1]

34° F.		45° F.	
Air	Controlled atmosphere	Air	Controlled atmosphere
60.8	53.5	44.5	72.4

[1]Burgheimer, F., *et al.*, 1967.

The preservation of fresh produce quality is of prime importance. The criteria for quality must include fresh appearance for consumer acceptance, high nutrient retention for good nutrition, and a high percentage of saleable produce for profitable marketing without causing prices to rise unnecessarily to cover losses of produce that must be discarded. An example of a positive correlation among these three factors was shown for persimmons which were vacuum packaged in polyethylene bags in contrast to those unpackaged (Table 8) (7).

TABLE 8. QUALITY ATTRIBUTES OF FRESH PERSIMMONS STORED FOR FIVE MONTHS AT 32°F.[1]

Attribute	Vacuum	Sealed, not evacuated	Ventilated bag	Unpackaged (control)
Vitamin C (mg/100g)	55.3	45.7	39.4	19.6
Firmness (Kg)	2.5	2.0	1.4	0.3
Percent saleable	72	56	22	0

[1]Kawada, K., *et al.*, 1978.

The above examples cover only a few of the many factors that affect the nutrient content of fresh fruits and vegetables between harvest and their purchase by consumers. Information concerning this subject is scarce. Research is needed to define the areas in which nutrient loss can be minimized to ensure high nutritional quality of fresh fruits and vegetables.

Consumer buying practices for fruits and vegetables. In March 1974, a survey was conducted to determine the dissatisfaction of consumers in purchasing food products (11). Figure 2 shows the amount of dissatisfaction by food group. These results indicate that consumers were less satisfied with fresh vegetables than with the average of all foods but that fresh fruits rated a little better than the average rating.

Each food group was further divided into individual food items to pinpoint specific areas of dissatisfaction. Table 9 lists the dissatisfaction scores on the basis of five attributes used to rate iceberg lettuce, potatoes, and tomatoes. Price was the factor with the greatest dissatisfaction score for all three vegetables, a factor which was typical of foods from all groups throughout the study. Other factors that were rated as most unsatisfactory were appearance and freshness in lettuce, appearance and selection in potatoes and ripeness and taste in tomatoes.

The consumer dissatisfaction scores for fresh apples and oranges appear in Table 10. Consumers were the least satisfied with the crispness, selection, and taste in apples and the taste in oranges. The fruits surveyed here rated best for appearance in contrast with vegetables for which appearance was consistently rated as one of the aspects with which consumers were most unhappy. This difference in the rating of appearance may be due to the types of fruits and vegetables surveyed because apples and oranges can maintain a fresh appearance for a fairly long time, whereas lettuce and tomatoes show deterioration more rapidly.

TABLE 9. CONSUMER SATISFACTION WITH FRESH VEGETABLE PRODUCTS AND THEIR ATTRIBUTES, 622 RESPONDENTS[1]

Variable	Average dissatisfied
	(score)[2]
Regular iceberg lettuce	2.54
Price	3.27
Taste	2.33
Packaging	2.33
Appearance	2.50
Freshness	2.45
Fresh potatoes	2.51
Price	3.61
Taste	2.24
Packaging	2.37
Selection	2.41
Appearance	2.44
Fresh tomatoes	2.97
Price	3.69
Taste	2.99
Packaging	2.58
Availability	2.70
Appearance	2.81
Ripeness	3.04

[1]USDA, 1975.
[2]On a scale of 1-5, with 5 being most dissatisfied.

TABLE 10. CONSUMER SATISFACTION WITH FRESH FRUITS AND THEIR ATTRIBUTES, 622 RESPONDENTS[1]

Variable	Average dissatisfied (score)[2]
Fresh apples	2.30
Price	3.36
Taste	2.34
Packaging	2.29
Selection	2.38
Appearance	2.18
Crispness	2.43
Fresh oranges	2.33
Price	3.26
Taste	2.35
Packaging	2.22
Selection	2.23
Appearance	2.14

[1]USDA, 1975.
[2]On a scale of 1-5, with 5 being most dissatisfied.

The scoring of these vegetables indicates that many areas of consumer dissatisfaction in purchasing fresh produce could be improved by careful handling and marketing practices. As we reported above, handling practices that assure high nutrient retention in fresh produce also assure high sensory quality that appeals to consumers and increases sales.

When consumers wish to purchase a fruit or vegetable, they must decide which form they will purchase--fresh, canned, frozen, or dried. Many factors enter into this decision such as availability, the intended use and cost. Those factors such as appearance, freshness, and selection as sighted in the survey on dissatisfaction with fresh fruits and vegetables can be approached through handling and marketing procedures.

The form in which vegetables are most often purchased is shown in Table 11 (12). The numbers reflect the percentages in which each form was purchased. Consumers in this survey were also asked to give reasons why they preferred purchasing their vegetables in fresh, canned, frozen, or dried form. The positive attributes that consumers most often associated with fresh vegetables are listed in Table 12. The data show that the fresh form is regarded most highly for its good taste, that consumers think that the fresh form has a higher level of nutrients and that they prefer its apperaance over that of frozen and canned.

TABLE 11. PERCENT[1] OF THE FORM IN WHICH SELECTED VEGETABLES WERE PURCHASED[3]

	Fresh	Canned	Frozen	Dried
	<------------------- (percent) ------------------>			
White potatoes	94	1	2	5
Eggplant	94	-[2]	2	-[2]
Carrots	91	6	3	-[2]
White onions	91	2	1	6
Turnips	91	3	5	-[2]
Squash	86	2	12	-[2]
Tomatoes	85	26	-[2]	-[2]
Cauliflower	67	1	33	-[2]
Sweet potatoes	65	34	2	3
Beets	17	83	1	-[2]
Green peas	11	61	31	1
Corn	35	53	18	1
Green beans	36	51	19	1
Asparagus	33	49	20	-[2]
Spinach	25	45	20	-[2]
Lima beans	9	38	38	17
Brussels sprouts	27	2	71	-[2]
Broccoli	33	3	66	-[2]
Black-eyed peas	15	36	14	38

[1]Of those surveyed who purchased that vegetable.
[2]Less than 1 percent.
[3]USDA, 1974.

TABLE 12. POSITIVE ATTRIBUTES THAT CONSUMERS ASSOCIATED MORE CLOSELY WITH FRESH VEGETABLES THAN WITH OTHER FORMS[1]

	Fresh	Frozen	Canned
	<-----------	*(percent)*	----------->
Tastes good	90	51	41
High in vitamins and minerals	72	27	16
Look appetizing at mealtime	65	34	20
Can use in many different ways	60	32	44
Appealing color	57	32	16
Usually available in stores (when in season for fresh)	56	37	41
Sure of good quality	49	30	24
Texture good	46	25	19

[1]USDA, 1974.

However, according to the negative attributes of fresh vegetables, consumers thought that fresh vegetables were more difficult to store and prepare and they did not keep as well as the processed forms (Table 13).

TABLE 13. NEGATIVE ATTRIBUTES THAT CONSUMERS ASSOCIATED MORE CLOSELY WITH FRESH VEGETABLES THAN WITH OTHER FORMS[1]

	Fresh	Frozen	Canned
	<----------	*(percent)*	---------->
Not easy to store	20	4	2
Does not keep well before cooking	17	3	1
Too much waste	17	5	6
Not easy to prepare	14	2	1

[1]USDA, 1974.

Conclusions. Fresh fruits and vegetables are important in human nutrition. When handled properly they are major contributors of vitamin A and C. Some are good sources of minerals and other vitamins. As a group, they tend to be low in calories and sodium and high in dietary fiber and potassium. The importance of these contributions is enhanced when they are considered in the light of the recommended increase in the consumption of fruits and vegetables. Only use of the best practices in producing, harvesting, handling, and marketing can deliver to consumers fresh fruits and vegetables of optimum sensory and nutritional quality and assure a profitable operation for producers and marketers.

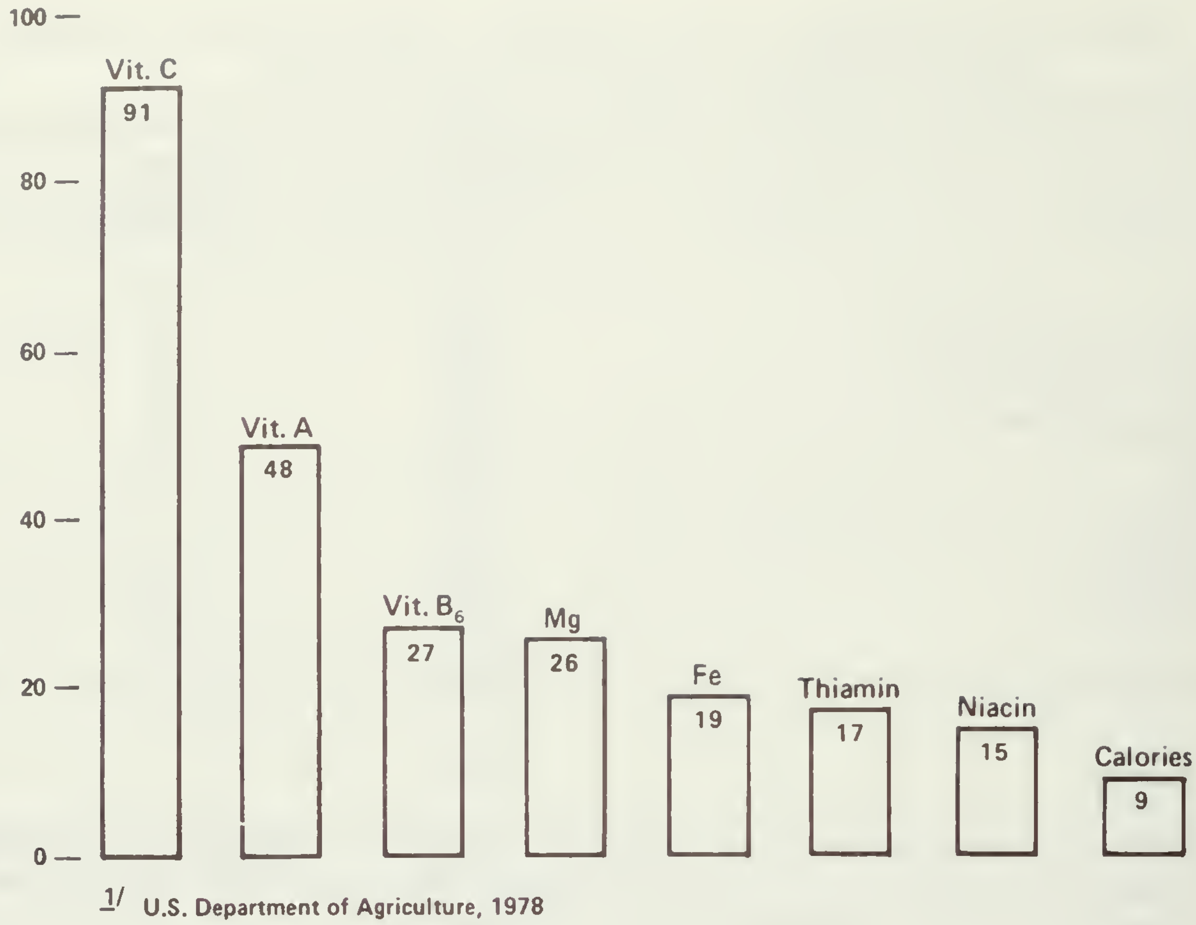

Figure 1. Percentages of selected nutrients and calories contributed by fruits and vegetables by consumption, 1976.

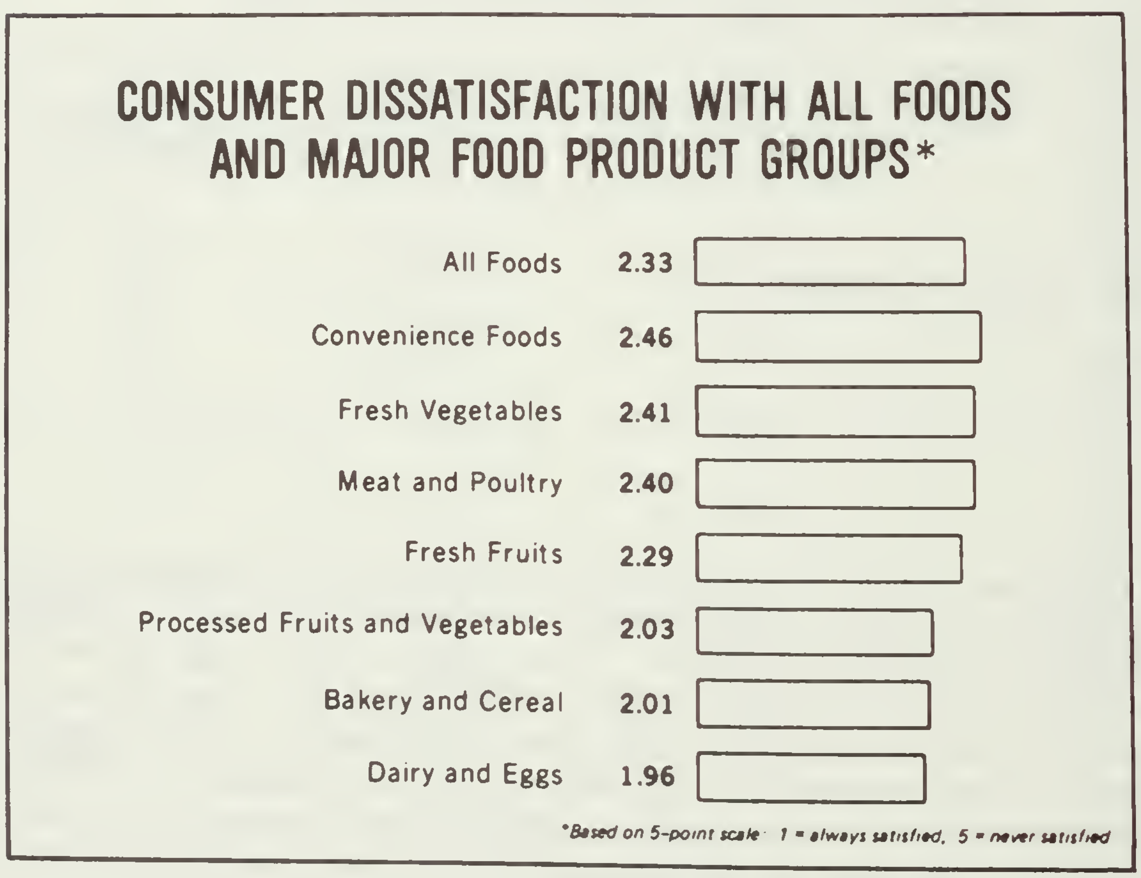

Figure 2. Consumer dissatisfaction with all foods and major food product groups.

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A MEASURE OF QUALITY

V. L. Porter

The consumer chooses fresh fruits and vegetables by appraising their quality (usually in relation to price). The relative values of quality vary with consumers for different products, markets, and times. In the market place quality is often identified by a standard measure. But before you can measure something you must define it. So let's see how Webster's Collegiate Dictionary defines quality:

a) the nature of something
b) a characteristic
c) class, kind or grade
d) a property
e) a standard of excellence
f) social status - high social status

This wide range of definitions explain why "quality" can have vastly different meanings when applied to different areas. Many times, especially on television and in newspaper ads, the word is misused and inferences are made to fool listeners and readers.

A specific standard, grade, characteristic or property, may be defined for products to aid in marketing. Who sets up these criteria? Is it an area that only experts and specialists are qualified? Even among specialists there may be a range of opinions on the definition of quality as it is related to a food product.

Ideally, objective techniques should be used whenever possible. Such criteria are size, bacteria count in processed products, shear test for maturity, chemical or instrumental techniques to evaluate sweetness, acidity, or color. But even these quality standards must be set by someone who determines what level of tests are acceptable or not acceptable.

Many quality attributes, by their nature, are subjectively evaluated and in the final analysis it is the consumer who has the most influence on quality standards. The person purchasing any product determines in his mind the important criteria to consider, and he buys on that basis. For example, a buyer may consider the color of the apple, the variety, and the place of purchase as most important. Therefore the requirements might be fulfilled by purchase of a bushel of red Jonathans directly from the orchard.

What are some important factors in the selection and purchase process at fruit and vegetable markets? Consumers may pre-judge quality based on prior purchases, the market reputation for cleanliness or freshness of products.

a) Appearance (shape, size, uniformity). This factor is often cited as one of the most important selectionfactors.
b) Color

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c) Condition (fresh, wilted, external damage)
d) Crop variety
e) Handling, packaging
f) Display, assortment
g) Lighting in stores and markets
h) "Anticipated" nutritional benefits
i) Safety--the entire organic gardening trend hinges on the real or imaginary safety of consumed foods
j) Convenience, location
k) Services offered, friendliness of owner, manager, and help
l) Price

What quality characteristics lead consumers to purchase at direct markets?

a) Freshness, vine-ripe "I picked it myself"
b) "Pureness" of products
c) Price savings
d) Availability of large quantities
e) The physchological or "down home" feeling from going to an orchard or farm and selecting a purchase from a bin, field, or basket
f) Recreation, family outing, social value
g) Status (it may cost more in time, gas and auto expenses to buy in direct markets)

In the final analysis, the *measure of quality* to purchasers depends on how well their expectations are fulfilled when preparing and consuming the products.

a) Good flavor and texture?
b) Crisp and fresh?
c) Products keep well?
d) Easy to prepare and free of waste?
e) More expensive than expected?
f) Did they serve a nutritional need?
g) Value for price paid?

These questions, among others, when answered satisfactorily determine to a large extent whether customers return to your market.

INFLUENCE OF SOIL FERTILITY ON VEGETABLE QUALITY

Fred C. Olday

Introduction

Soil fertility is commonly associated with its effects on crop yield; however nutrient imbalances in the soil can also have a marked influence on crop quality. Quality in vegetable crops can be considered as the sum total of attributes which determine the degree of acceptability of a given vegetable product by the consumer (11). A simpler definition of quality in vegetables would be "that which the public likes best" (2). For purposes of the present discussion, the quality attributes of vegetables are subdivided into three headings: External appearance, nutritional value, and utility value (11).

External Appearance

Consumer preferences are often based upon such external quality attibutes as size, shape, color, firmness, and freedom from defects. Appearance is important because of consumers' earlier associations between appearance and the flavor, texture, and keeping quality of the product (11). Consumer preferences also change with time and are influenced by such variables as consumer knowledge, cultural background, and economic circumstances.

The influence of soil fertility on the yield and on the size of vegetables is well known to growers. Generally, both yield and size are improved as fertility is increased from a low level to that considered optimum. There is usually no economic benefit in applying fertilizers beyond the optimum level since production costs increase with little improvement in either yield or produce size. For example, excessive nitrogen application, especially with vegetables grown for their fruits or storage organs, can result in excessive vegetative growth, delayed maturity, and production of less desirable grades (8).

The influence of soil fertility on the external appearance of vegetables, apart from its effect on size, is far more subtle. Only when extreme deficiencies or excesses of plant nutrients exist in the soil is the external appearance of vegetables modified to the extent that a decline in quality results. The most common effects of nutrient imbalances in the soil include: (a) Lack of firmness, (b) shape distortions, (c) development of off-colors, and (d) physical defects (e.g., pits, cracks, lesions). Table 1 outlines some of the effects of plant nutrient imbalances upon the external quality of selected vegetable crops.

In general, differences in external quality have been found to be more closely related to cultivar, climate, stage of harvest at maturity, and post-harvest

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handling than to fertility. A well-fertilized crop will therefore be a high quality crop if an adapted cultivar is grown using good management practices on suitable soil, if it is harvested at the proper stage of maturity, and if it is handled properly in the distribution system (15).

Nutritional Value

The nutritional value of vegetables lies in their ability to provide essential factors to the human diet. In this regard, they are important sources of vitamins, minerals, and dietary fiber. They are major sources of vitamins A and C, and good sources of vitamin B_6, thiamin, niacin, magnesium, and iron (5,11). They are less important than grains, for example, in the provision of carbohydrates, fats, and proteins to the human diet. Some vegetables may also serve as sources of substances which are toxic or deleterious to humans under certain conditions. Examples of such substances are nitrates, trypsin inhibitors, anti-thyroid factors, and alkaloids (11).

Numerous studies have assessed the influence of soil fertility on the vitamin and mineral content of vegetables (7,14,15,16). Examples of the effects of fertility upon the nutritional value of selected vegetable crops are provided in Table 2. In general, the principal effect of soil improvement, in terms of human health, has been to increase the yield of a given crop, rather than to increase its nutritional quality (9). Factors such as cultivar, location, season, maturity at harvest, post-harvest handling, and processing have greater effects upon the nutritive value of vegetables than do fertilizer practices, provided the crops have been grown without a serious deficiency of any of the essential fertilizer elements (5,8,9,14,15). Indeed, the influence of factors other than soil fertility may be so marked that the smaller differences produced by fertilizers are likely to be of little practical importance. Furthermore, premium prices are not necessarily paid for vegetables that contain high amounts of vitamins and minerals, thus providing little incentive for growers to add fertilizers other than to improve yield and appearance (5,15).

Utility Value

Utility value is mainly the suitability of vegetables for certain processed products in the food industry (11). Examples of known effects of soil fertility on the utility value of selected vegetable crops are given in Table 3. Reduced utility quality of vegetables grown for processing usually results from either an excess or deficiency of a given nutrient in the soil. On the other hand, high but not excessive levels of certain nutrients may enhance the utility value of vegetables, as in the case of the high sulfur requirement of horseradish, or the high nitrogen requirement of peas. Growers' knowledge of the nutritional requirements of a particular crop combined with an understanding of processors' raw product specifications largely avoid problems of lowered utility value arising from nutrient imbalances in the soil. Problems associated with cultivar, season, and stage of maturity at harvest have typically been of greater concern to processors in the past than those related to soil fertility.

Growers Suggestions

Since the influence of soil fertility on vegetable crop quality, apart from its affect on yield and size of vegetables, does not become apparent except under conditions of extreme nutrient deficiencies or excesses, lowering of vegetable crop quality due to nutrient imbalances can be largely avoided by:

(1) Knowing the fertilizer requirements of the crops grown,
(2) Being aware of any limitations imposed by the soil (e.g., coarse texture, pH extremes, high organic matter content, poor drainage),
(3) Having the soil tested on a regular basis (e.g., every 3-5 years),
(4) Fertilizing and liming according to soil test recommendations, and
(5) Adhering to other good crop management practices.

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Table 1. INFLUENCE OF MINERAL NUTRITION UPON THE EXTERNAL APPEARANCE OF SELECTED VEGETABLE CROPS (Continued)

Vegetable Crop	Nutritional Conditions[1]	Effect[2]	References
Salad Crops			
Lettuce	B (<)	Death of terminal bud, brittle cup-shaped leaves	13
"	B (<)	Terminal bud leaves distorted, necrotic margins	3
"	Mn (<)	Interveinal chlorosis, mottling	3,17
"	Cu (<)	Leaves cupped, heads loose	3
"	Mo (<)	Heart formation poor	3
Cole Crops			
Broccoli	B (<)	Brown, dry areas in heads	13
Brussels Sprouts	K (<)	Sprouts poorly developed	3
"	Ca (<)	Internal tipburn, browning	2,10,17
Cabbage	N (>)	Bursting of heads	2
"	K (<)	Heads loose, puffy	3
"	Ca (<)	Internal tipburn	3,10
"	B (<)	Internal breakdown of stem in head region	3,13
"	Mo (<)	Heart formation poor	3
Cauliflower	B (<)	Brown heart; hollow stem, browning of curd	2,3,4,13 17
"	Mo (<)	Flower curds irregular	3
Greens			
Beet Greens	Mn (<)	Interveinal chlorosis, mottling	17
Collard	B (<)	Leaves yellow, wrinkled; stems hollow	3
Kale	B (<)	Leaves yellow, wrinkled; stems hollow	3
Spinach	N (<)	Yellowing, drying of older leaves	17
"	K (<)	Scorching of leaf margins, tipburn	3,17
"	B (<)	Yellowing of plant, deformation of young leaves	4
"	Mn (<)	Yellows disease; interveinal chlorosis, mottling	3,13,17
"	Mo (<)	Leaves chlorotic, cupped	3
Solanaceous Fruits			
Pepper	Ca (<)	Blossom end rot	2,3,10
Tomato	N (>)	Soft fruit, green-colored jelly	8
"	K (<)	Blotchy ripening	2,3,17
"	Ca (<)	Blossom end rot	2,3,10,17
"	B (<)	Dry, pitted areas in skin; uneven ripening	3,17
"	Fe (<)	Pale fruit	4

(continued)

Table 1. INFLUENCE OF MINERAL NUTRITION UPON THE EXTERNAL APPEARANCE OF SELECTED VEGETABLE CROPS

Vegetable Crop	Nutritional Conditions[1]	Effect[2]	References
<u>Root Crops</u>			
Beet	K (<)	Roots dark, poorly developed, tend to rot	3
"	Ca (<)	Roots forked and turned	3
"	B (<)	Canker; girdle; internal black spot	2,3,13,17
Carrot	K (<)	Roots spindly, short	3
"	Ca (<)	Cavity spot; canker-like cavities on root	2,10
"	B (<)	Shadow; small brown lesions on root[3]	2
"	B (<)	Woody, hollow, blunt-tipped roots	4
"	B (<)	Roots with deep, wide splits	3
Parsnip	Ca (<)	Cavity spot; canker-like cavities on root	10
Potato	N (>)	Growth cracks, knobs	8
"	P (<)	Internal lesions	3
"	K (<)	Bluish tuber flesh	3
"	Ca (<)	Necrotic spots in tuber	3
"	B (<)	Tubers rough, cracked, small	3
Radish	N (<)	Roots small, imperfectly developed	3
"	P (<)	Poor root development	3
"	B (<)	Darkening of root tissue	3,4
"	B (<)	Pale color, failure of roots to thicken	4
Rutabaga	B (<)	Mottled heart	4
"	Mn (<)	Roots rough, cracked, with internal lesions	3
Sweet Potato	B (<)	Internal brown spot; corkiness	13
" "	B (<)	Internal dark streaks	3
Turnip	B (<)	Brown heart; internal browning	3,13,17
<u>Salad Crops</u>			
Celery	K (<)	Petioles short, with necrotic areas	3
"	Ca (<)	Blackheart; heart leaves die early	3,10,17
"	B (<)	Cracked-stem; mottling of bud leaves	3,4,13,17
Escarole	Ca (<)	Brown heart	10
Lettuce	N (<)	Yellowing, drying of older leaves	3,17
"	P (<)	Poor head formation	3
"	K (<)	Scorching of leaf margins, tipburn	3,17
"	Ca (<)	Tipburn	3
"	Mg (<)	Chlorotic mottling, followed by yellowing	3

(continued)

Table 1. INFLUENCE OF MINERAL NUTRITION UPON THE EXTERNAL APPEARANCE OF SELECTED VEGETABLE CROPS (Continued)

Vegetable Crop	Nutritional Conditions[1]	Effect[2]	References
<u>Legumes</u>			
Dry Bean	Mn (<)	Marsh spot; circular brown areas on interior surfaces of cotyledons	17
Dry Pea	Mn (<)	Marsh spot; circular brown areas on interior surfaces of cotyledons	17
Pea	K (<)	Pods poorly filled	3
Snapbean	Ca (<)	Imperfect development of pods and seeds	17
<u>Vine Crops</u>			
Cantaloupe	K (<)	Fruit splits at blossom end	3
Cucumber	N (<)	Fruit light in color, pointed at blossom end	3
"	P (<)	Fruit dull bronze-green	3
"	K (<)	Fruit constricted at stem end	3
<u>Bulb Crops</u>			
Onion	N (>)	Doubles, splits	8
"	K (<)	Poor bulb formation	3
"	Cu (<)	Scales thin, pale yellow; bulbs loose	3,13
<u>Other</u>			
Sweet Corn	P (<)	Incomplete earfill	2,3

[1] Symbols used are as follows: (<) nutrient deficient; (>) nutrient in excess.

[2] Appearance of the edible portion of the crop; effects upon yield, size, and appearance of non-edible plant structures not included.

[3] Not readily detectable in the raw product.

Table 2. INFLUENCE OF MINERAL NUTRITION UPON THE NUTRITIONAL VALUE OF SELECTED VEGETABLE CROPS

Vegetable Crop	Nutritional Conditions[1]	Effect	References
Beet	N (>)	Nitrate accumulation	...
Beet Greens	Ca (<,>)	Reduced provitamin A content	16
" "	Na (<,>)	Reduced provitamin A content	16
Brussels Sprouts	Mn (<,>)	Reduced vitamin C content	16
Bulb Crops	S (h)	Increased level of anti-thyroid factors	11
Carrot	Mg (<)	Reduced provitamin A content	12
"	K (<,>)	Reduced provitamin A content	16
Cauliflower	Mo (<)	Reduced vitamin C content	13
Cole Crops	S (h)	Increased level of anti-thyroid factors	11
Lettuce	K (<,>)	Reduced provitamin A content	16
Potato	Mg (<)	Decreased starch content	12
Spinach	N (>)	Nitrate accumulation	...
"	N (>)	Reduced biological value of protein	16
"	N (<,>)	Reduced vitamin B_2 content	16
"	Mg (<)	Reduced provitamin A content	12
Tomato	Mo (<)	Reduced vitamin C content	13

1 Symbols used are as follows: (<) nutrient deficient; (>) nutrient in excess; (<,>) nutrient deficient, or in excess; (h) nutrient level high but not excessive.

Table 3. INFLUENCE OF MINERAL NUTRITION UPON THE UTILITY VALUE OF SELECTED VEGETABLE CROPS

Vegetable Crop	Nutritional Conditions[1]	Effect	References
Beet	N (>)	Internal can corrosion	...
"	P (h)	Deep red color	15
Carrot	N (>)	Off-flavors develop upon canning	11
Horseradish	S (h)	Increased pungency of roots	6
Pea	N (h)	Enhanced tenderness	15
Potato	N (>)	Shortened storage life	5
"	N (>)	Dark colored, oil-retentive potato chips	5,8
"	K (<)	Internal blackening upon peeling and cooking	5,8
Snapbean	Ca (h)	Enhanced firmness of canned product	15
Spinach	N (>)	Internal can corrosion	...
Tomato	N (>)	Off-flavors develop upon canning	11
"	Ca (h)	Enhanced firmness of canned product	15

[1] Symbols used are as follows: (<) nutrient deficient; (>) nutrient in excess; (h) nutrient level high but not excessive.

PESTICIDES AS INFLUENCING QUALITY OF VEGETABLES

H. J. Hopen

Quality. Quality has been defined in a recent review article as having both physical and chemical attributes relative to vegetables. Pesticides can affect both physical and chemical quality.

Quality is defined as a class, kind or grade of a particular commodity. It is usually assumed that when we say "quality" we are dealing with the best or finest quality which can be obtained under a particular set of circumstances.

Pesticides only maintain quality. Quality, or a certain level of quality, is usually demanded by the consumer and is classified by various classes or grades. This grade is what the consumer pays for. Relative to pests and pesticide usage, there is usually no additive or positive effects from pests or pesticide usage, but only a maintenance of the quality which is already established before pests are controlled or pesticides used. That is, pesticides are only an aid in maintaining the inherent qualities of the vegetable product.

In considering the effects of pests on vegetables, and the consequent use of pesticides, we are dealing with the effects of weeds, insects and mites, and a whole range of diseases caused by bacteria, fungi and viruses.

Estimates have been made of losses due to various pests. In 1969 in the central U.S. there were reported losses in potatoes, to weeds alone, of 8,600 pounds per acre in yield and 1,500 pounds per acre in lower quality or a total of 10,100 pounds per acre (4).

For all crops in the U.S. in 1965 there were losses of: Weeds - $5,064,000,000; Insects - $4,298,000,000; Diseases - $3,779,000,000 (4).

With a magnitude of loss to pests of this scale the grower must try to reduce both yield and quality loss. Because of cost and lack of labor pesticides are an essential part of modern pest control practices. In California weeding peppers without a selective herbicide cost $98.00 per acre but with a preemergence herbicide was cut to $45.00 per acre (4). Informal discussions with Illinois onion growers revealed a savings in weeding of $30.00 per acre with the addition of a postemergence herbicide to the weed control program.

Use resistant varieties. A first line of defense against pests should be the use of resistant varieties wherever possible. Resistant varieties are usually used for disease avoidance or control. Varieties should be selected not only for disease resistance, but for the best possible desirable horticultural characteristics available. Plant breeders have done a good job in the past several decades of

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incorporating disease resistance and desirable characteristics into commercially available varieties, and growers have generally made use of these.

Benefits of pesticides. Some of the positive effects of the use of pesticides are: a common effect of controlling diseases, insects and weeds is a yield increase. This is not a quality effect, but it has a definite impact on the economic situation which a grower finds himself in at the end of a cropping season. The presence of weeds provides the most consistent and dramatic effect on yield and the use of mechanical control and/or herbicides will result in increased yields in most situations. Other categories of pests can have a negative effect on yield whether they be insect or disease effects. Another benefit is having a controlled size product depending on the particular situation and marketing demand. Yield increase is, therefore, usually a reduction of competition whether it be from weeds, insects or diseases.

Blemishes are primarily caused by insect and disease problems and are a factor in most quality determinations. These quality determinations are for both vegetable fruit crops, such as tomatoes and peppers, and leafy vegetables of the various categories cabbage, lettuce, spinach, etc. Control of insect and disease factors with insecticides or fungicides usually will result in higher quality readings.

The avoidance of distortion of root crops such as carrots can result in greater quality ratings when problems are caused by nematodes or yellows disease. Quite often, in these situations the need for soil fumigation is recognized, which results in higher quality. Crop rotation can also be practiced in these situations which can result in reduced pest levels.

Quality can often be increased by the avoidance of contamination by insect parts or rodent droppings and the use of the appropriate pesticide can reduce this factor.

Often the proper growth stage may be reached before the plant has completed its vegetative growth. A quality determination in onion set production is the proper size for onion sets to be planted the following year. With the recent advent of mechanical harvesting of onion sets and better cultural conditions for growing this crop, it is now sometimes necessary to stop the topgrowth of the plant before total growth is made. The same type of situation occurs in the marketing of potatoes, where again the topgrowth must be killed to facilitate harvesting. These types of activities are vegetative growth killing operations, and quite often these are accomplished by the use of pesticides which are classified as general or nonselective herbicides.

Growth regulators are classified as pesticides by the Environmental Pesticide Agency and are used in some crops to aid in improved growth, development and the ripening of vegetable fruit. Ethephon is an example of a growth regulator which is currently used in tomato production to facilitate concentrated ripening and defoliation of tomatoes for mechanical harvesting.

In the past several years overall consumer attitudes of pesticides have been negative. This is not an absolute truth, but there have been negative connotations by many consumers relative to pesticide usage. However, these same consumers demand a quality product that is free from defects and it is usually necessary to use pesticides to obtain defect-free quality vegetable products.

Pesticides must be registered for use by the Federal Environmental Pesticide Agency (EPA) before legally being used on a food or fiber product. The basic manufacturer of a pesticide must spend several million dollars to assure the EPA that their product is effective for the purpose intended and not harmful to consumers.

Pesticide surveillance is carried out by the EPA to provide a safe consumer product In traveling the state of Illinois during 1978 several growers reported that their fresh market vegetables had been purchased by persons they found later to be employed by the EPA. In all instances mentioned to the author no tolerances were exceeded or illegal residues were found. It is important that growers strive to maintain this positive record.

Pesticide problems. Pesticides can have an effect on flavor. There is usually not an adverse effect on flavor with pesticide use, but it has been a policy of many vegetable processors to analyze produce by a flavor and taste test before these pesticides are used on commercial acreages. It has recently become a more common practice for University investigators to also test flavor and taste when evaluating new pesticides in vegetable crops. These tests are now also being called for in Environmental Protection Agency protocols.

Strictly negative effects which can occur from use of pesticides can be one of several. Most vegetable crops, except sweet corn and asparagus, are adversely affected by the phenoxy herbicides and growth and quality reduction can occur from small amounts of these herbicides. An example is the drif ng of 2,4-D or 2,4,5-T onto tomato or any of the fruiting vegetables. Other type herbicides with high drift potential, such as dicamba can have detrimental effects on vegetable quality.

There can be adverse effects from any class of pesticides if too high a rate upsets the environment that it is used in. In these situations the pesticide does not interact correctly to give a protective-type action but a growth reduction or quality reduction. An example of this might be the use of insecticides on sweet corn for control of earworm or other insects if applied a large number of times to control continuing insect populations. There can be a growth reduction of the corn plant which will result in less sugars being developed and a reduction in corn ear quality.

Example crop - sweet corn. We have been dealing with theoretical type effects in the most part, so at this point let's look at some of the interrelations of pests that can affect quality in sweet corn.

Weeds can affect the competitive ability of sweet corn and the availability of nutrients and water to the sweet corn which can reduce yield or number of ears per acre and also the size of the individual ear. Higher weed populations will usually result in smaller ear sizes in any given cultivar. Weeds can also serve as hosts for diseases. Johnson grass serves as a host for the maize dwarf mosaic virus. One solution is to control Johnson grass so the mosaic disease does not get a foothold.

Sweet corn production is plagued by several insects. Aphids can cause stunting and the production of a sticky substance which provides a growth medium for sooty mold. Ear worm and sap beetles can reduce quality by the maggots and ear worm present in the ear, a situation which is unacceptable to most consumers. Corn borer can cause a destruction of the sweet corn ear, can be present in the ear and can be classified as unacceptable by the consumer, and can also cause a yield reduction. The adult beetles of the corn root worm can cause an incomplete ear fill of sweet corn which is therefore classified as lower quality. The corn flea beetle can serve as a vector for Stewart's disease, which is a serious problem of sweet corn in some parts of Illinois.

Sweet corn is also plagued by several diseases, which can cause poor quality. A virus disease such as maize dwarf mosaic, which is spread by aphid vectors by weed hosts is a serious Illinois problem. Maize dwarf mosaic can result in poor quality ears, which are incompletely filled with kernels and have a small size. The fungus called smut can cause complete replacement of the ear which results in lower yields in all situations but in serious infections drastically reduces yields. Stewart's disease, which is spread by the corn flea beetle, can result in poor quality ears because of a lack of sweetness and sugars in the ear and also poor vegetative growth resulting in a lower yield. Northern corn leaf blight and rust can cause a lower level of sugars in sweet corn ears, which is the main reason that late planted acreages of sweet corn are sprayed with a fungicide so that the chlorophyll levels of the plant can be maintained and not reduced by these diseases. If the chlorophyll levels in the plant are maintained, higher levels of sugar are usually present in the sweet corn ear.

Growers should therefore be knowledgeable of problems which can be caused by diseases, insects and weeds and judiciously use pesticides to maintain inherent quality. Carefully chosen, disease resistant cultivars which are currently available in today's marketplace can improve quality. Consumer acceptance is dependent on the use of pesticides to maintain the high quality which results in a premium price for a quality product.

The University of Illinois attempts to help the vegetable growers through information such as pesticide suggestions (1,2,3), state-wide meetings at Urbana-Champaign, at regional schools and by conducting pest control research on major problems.

References. Suggestions for Pesticide Use on Vegetables, University of Illinois Circulars:

1. Circular 897 - Insect Pest Management Guide -- Commercial Vegetable Crops and Greenhouse Vegetables.
2. Circular 907 - Herbicide Guide for Commercial Vegetable Growers.
3. Circular 999 - Fungicide Guide for Commercial Vegetable Growers.

4. Modern Weed Control. A. S. Crafts. Univ. of California Press. 440 pp. 1975.

TOXICITY AND HAZARDS OF PESTICIDES

Roscoe Randell

Pesticides are poisonous. They have to be poisonous to kill undesirable plants, insects, diseases, or other pests. Safe and proper use of pesticides depends upon a knowledge of their toxic properties and a respect for the potential hazards associated with their use.

Toxicity. Toxicity is the inherent capacity of a pesticide to produce injury or death. If you know the toxicity of a pesticide, you will know what precautions to take.

Tests are performed with each pesticide to determine the toxicity to rats, rabbits, guinea pigs, or other animals. These tests are helpful in determining how hazardous the pesticide probably would be to humans.

In oral tests, the animal is given quantities of the pesticide by mouth according to the animal's body weight. The dose is increased until the dose that will kill 50 percent of the test animals is found. This lethal dose (deadly amount) is called "Oral LD_{50}." The dose is expressed in milligrams per kilogram of body weight (m/kg). There are 1,000 mg in a gram and 454 grams in a pound. A kilogram (kg) is 2.2 pounds. If a pesticide has an Oral LD_{50} of 100, then 100 mg (1/10 of a gram) of the pesticide are required to kill 5 out of 10 test animals each weighing a kilogram. A compound with an Oral LD_{50} of 100 is dangerous because 1/90 of a pound (1 to 2 teaspoons) could kill a human. The lower the LD_{50} number, the more toxic the pesticide.

In dermal tests, the pesticide is placed on the skin of the test animal and covered with a bandage so that it will remain on the skin for 24 hours. If 100 mg of the pesticide are required to kill 5 out of 10 test animals weighing one kilogram, the Dermal LD_{50} is 100.

In inhalation tests, the test animals are placed in an airtight container with specific quantities of the pesticide. The animals remain in the container for one hour. Inhalation values called LC_{50}'s are measured in micrograms per liter (μg/l). The LC_{50} is the lethal concentration that will kill 50 percent of the test animals. There are 1,000 micrograms (μg) in one milligram (mg). One liter is equal to 1.06 quarts. An LC_{50} of 100 means that 100 micrograms per one quart of air are required to kill 5 out of 10 test animals when they are exposed for one hour. LC_{50} also refers to toxicities of fish in water and is expressed in parts per million (ppm).

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Table 1 gives the oral and dermal LD_{50} for pesticides with high, moderate, low, and very low toxicity. Highly toxic pesticides contain a drawing of a skull and crossbones and the words "Danger-Poison" on the label. Moderately toxic pesticides contain the word "Warning" on the label; and pesticides with low and very low toxicity contain the word "Caution" on the label. All pesticide labels carry a "Keep Out of Reach of Children" warning.

Table 1. Oral and Dermal Toxicity Ratings of Pesticides

Toxicity rating	Label signal words	Oral LD_{50}	Dermal LD_{50}	Lethal oral dose, 150-pound man
		(mg/kg)	(mg/kg)	
High	Danger-Poison	0.50	0.200	Few drops to 1 tsp.
Moderate	Warning	50-500	200-2000	1 tsp. to 1 oz (2 TB)
Low	Caution	500-5000	2000-20,000	1 oz to 1 pt+ or 2 lb
Very low	Caution	5000+	20,000+	1 pt or 2 lb

Hazards. Do not depend upon toxicity values alone as a measure of the hazard of a pesticide to humans or other animals. You must also be concerned with the hazards associated with exposure to the pesticide.

Hazard and toxicity are not the same. Hazard is a combination of toxicity and exposure. It is the potential threat that injury will result from the use of a pesticide in a particular formulation or quantity. Some hazards do not involve toxicity to humans or other animals. For example, sulfur, oils, and numerous other chemicals are considered safe or relatively safe to animals but may cause considerable injury to some plants (phytotoxicity).

A compound may be extremely toxic but present little hazard when used (1) in a very dilute formulation; (2) in a formulation that is not readily inhaled or absorbed through the skin; (3) only occasionally and under conditions in which humans are protected with protective equipment and clothing; and (4) only by knowledgeable applicators who are properly equipped to handle the chemical safely.

Conversely, a chemical may be relatively nontoxic but present a hazard because it is normally used in a concentrated form that may be readily absorbed or inhaled. Or it may be used by the nonprofessional, such as the home gardener, who is not aware of the possible hazards to which he is being exposed.

A pesticide concentrate may be toxic if taken orally, but it may not be hazardous when diluted with water and applied by a knowledgeable applicator. Another pesticide may not be extremely toxic as it comes from the bottle, but it can be a hazard if it is used in a careless manner and allowed to get on the skin day after day.

Complete information is not available on the toxicity of all pesticides. For example, very little information is available on the effects of commonly used fungicides (other than mercury) and herbicides on birds, fish, and bees. Insecticides have been more thoroughly studied.

Table 2 shows the toxicity of some common fungicides, bacteriocides, and nematicides, including the acute oral LD_{50} for rats and possible skin reactions of humans.

Table 2. Uses and Toxicity of Common Fungicides, Bactericides, and Nematicides

Name	Oral LD_{50} (mg/kg)	Dermal irritation
Benlate, Tersan 1991	9,590	none to mild
Orthocide, Captan	9,000	none to mild
Bravo, Dacanil 2787, Exotherm Termil	10,000	mild
copper	3,000-6,000	mild
Botran	5,000	mild
Karathane	980	mild
Cyprex	1,000	mild
Phaltan, Fungitrol	10,000	mild
Manzate D, Dithane M-22	6,750	mild
Dithane M-45, Manzata 200	6,160	mild
methyl bromide	200 ppm(vapor)	severe
Polyram	6,400	mild
Dithane 78, Zineb	5,200	mild

Table 3 shows the name, oral LD_{50}'s worker reentry time and toxicity of common insecticides. Birds, fish, and bees would not be exposed to insecticides used for soil, livestock, and household insect control.

be 3. Name, Oral LD_{50}'s, Worker Reentry Time, and Toxicity of Common Insecticides

m	Oral LD_{50}	Toxicity to mammals: Acute oral	Acute dermal	Worker reentry time	Toxicity: birds	fish	bees
tene	361	moderate	moderate	*	moderate	low	NA
tion	11	high	moderate	1 day	moderate	NA	high
vn	500	low	low	*	low	very low	high
rdan	8	high	low	*	high	NA	NA
rban	97	moderate	moderate	*	moderate	NA	NA
sox	2	high	high	2 days	moderate	moderate	low
lhane	1,000	low	moderate	*	low	high	low
gn	215	moderate	moderate	*	moderate	low	high
snit	2	high	high	*	high	NA	NA
fnate	16	high	high	*	moderate	NA	NA
ntor	18	high	high	*	NA	NA	NA
nate	17	high	moderate	*	low	NA	NA
tom	250	moderate	moderate	*	low	high	high
iet	1	high	high	*	moderate	NA	moderate
ian	147	moderate	low	*	moderate	NA	NA
rthrin	820	low	moderate	*	NA	high	low
tnone	50-75	moderate	moderate	*	NA	high	low
uter	4	high	high	*	high	high	NA
lx	560	low	low	*	moderate	low	low

= Based on technical product.

Not available.

=Worker cannot enter a treated field without protective clothing until the spray has dried or the dust has settled.

Table 4 shows the oral LD_{50}'s and dermal toxicity and irritation of common herbicides. Herbicides do not usually cause severe skin irritation and most of them are not rapidly absorbed through the skin. However, you should always read the label, use rubber gloves, and take all necessary precautions.

Table 4. Name, Oral LD_{50}'s, and Dermal Toxicity and Irritation of Common Herbicides

Name	Oral LD_{50} (mg/kg)	Dermal toxicity	Dermal irritation	Toxicity to fish
Lasso	1,200	low	mild	moderate
AAtrex, Atratol	3,080	low	mild	low
Basagram	1,100	low	moderate	low
Modown	10,000	low	moderate	moderate
Sutan+	3,880	low	mild	low
Amiben, Vegiben	3,500	low	mild	low
Tenoran	3,700	low	mild	low
Bladex	334	low	mild	low
2,4-D	375-1,000	low	mild	low to modera
Basfapon, Dowpon	7,570	low	moderate	low
Dacthal	3,000	low	mild	low
Banvel	1,040	low	mild	low
Eptam, Eradicane	1,370	low	mild	low
Basalin	1,550	low	moderate	moderate
Roundup	4,900	low	moderate	low
Lorox	1,500	low	mild to moderate	low
Lexone, Sencor	1,940	low	mild	low
TOK	1,470	low	mild to moderate	low
Paraquat	120	moderate	moderate	low
Prowl	1,050	low	mild	moderate
Tolban	2,200	low	mild	moderate
2,4,5-T	300	moderate	mild	low to modera
Treflan	3,700	low	mild	moderate

1978 VEGETABLE INSECT SITUATION

Roscoe Randell

The 1978 growing season was somewhat normal following a very severe winter of low temperatures, and a heavy snow cover. The snow cover aided in the successful overwintering of some insects.

Corn insects. European corn borers completed a successful first generation in June and July and also increased (in high numbers) in August during the second generation. The highest populations were found in western, northern, and west-central sections of the state. Fall survey counts in these areas were as high as the record years of 1948 and mid-1950's (Map 1).

Black cutworms were present in moderate numbers over much of the central and northern part of the state in May.

Vine crops. Striped cucumber beetles successfully overwintered and transmitted bacterial wilt to melons and cucumbers. Squash bugs overwintered in or near pumpkin fields and became a problem in late summer as populations increased. Only Dylox is labeled and is effective against most immature squash bugs.

Bean insects. Corn borers attacked snap beans in August and September. Populations were often as high in beans as they were in corn.

Other. Corn rootworm populations decreased considerably from 1977. Corn borers were a problem in pepper plantings in late season. Grasshoppers hatched in June and migrated into corn, beans, and other vegetables throughout the summer (Map 2).

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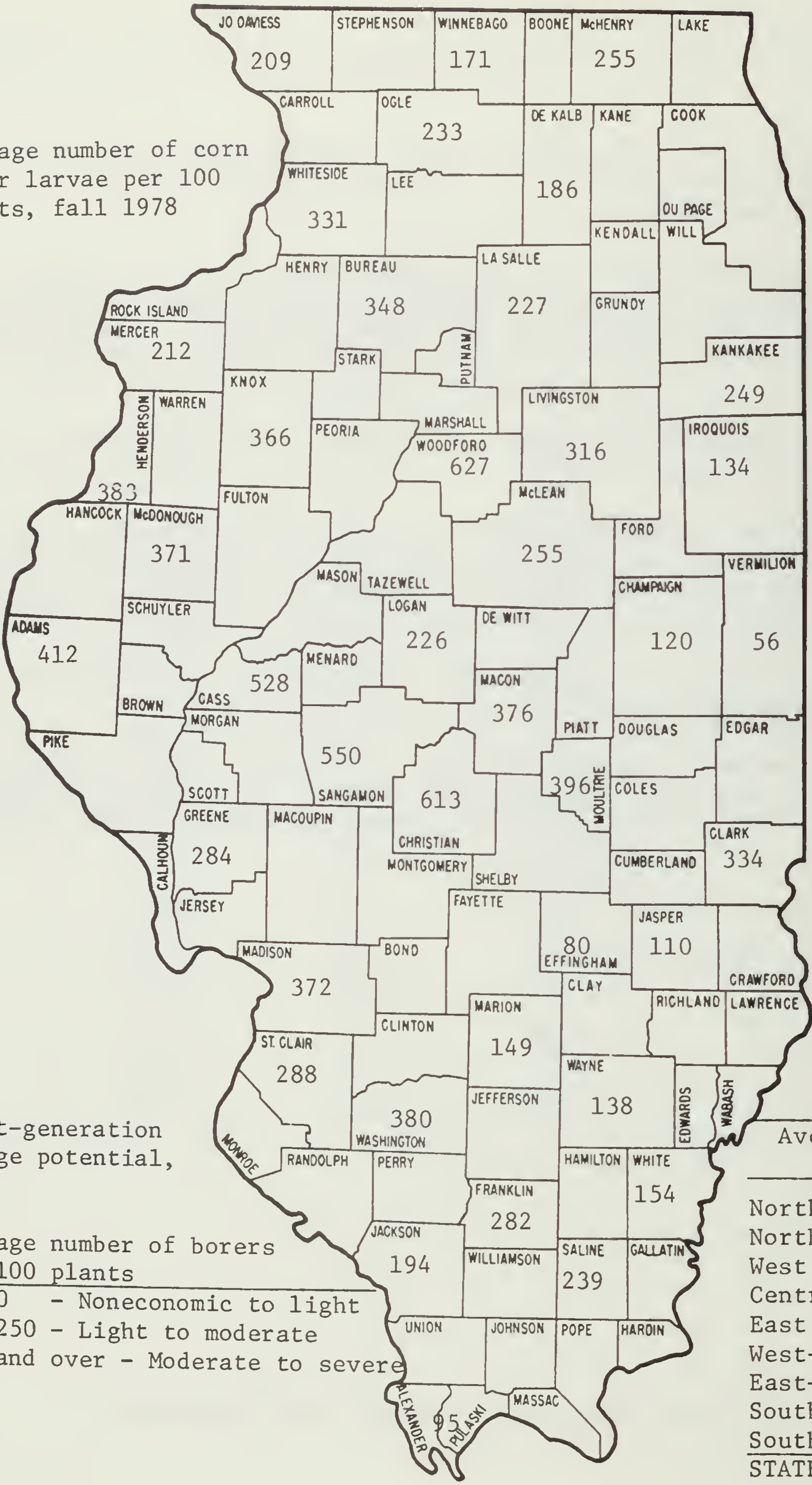
Map 1. European corn borer prospects for 1979

Average number of corn borer larvae per 100 plants, fall 1978



First-generation damage potential, 1979

Average number of borers per 100 plants

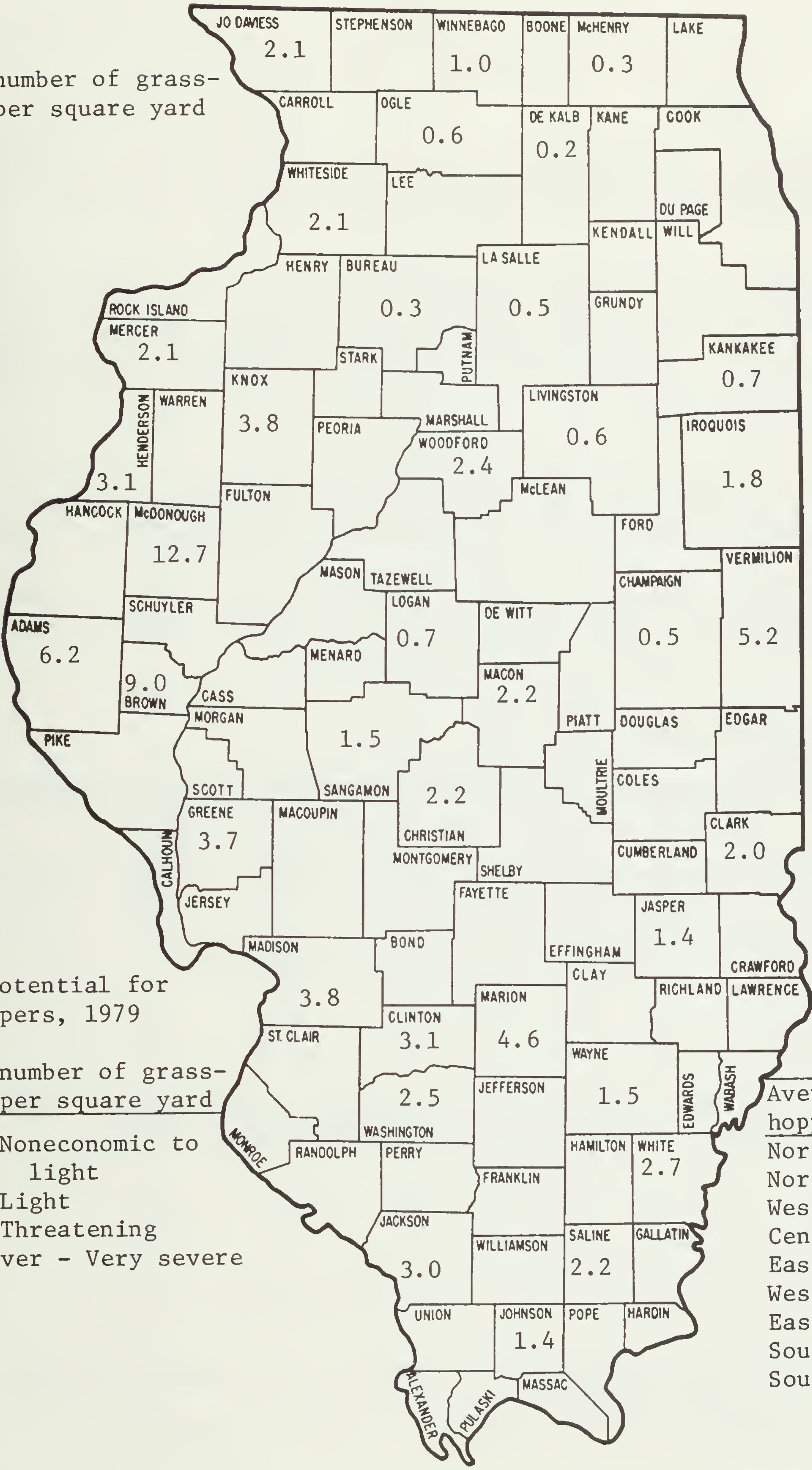
0-100 - Noneconomic to light
100-250 - Light to moderate
250 and over - Moderate to severe

CORN BORE
POPULATION
BY DISTRIC
FALL, 197

Average number of per 100 plant
Northeast. . . . .
Northwest. . . . .
West . . . .
Central. . . . . .
East . . . .
West-southwest . . .
East-southeast . . .
Southwest. . . . .
Southeast. . . . .
STATE

Map 2. Grasshopper prospects for 1979

Average number of grasshoppers per square yard



Damage potential for grasshoppers, 1979

Average number of grasshoppers per square yard

0-3 . . Noneconomic to light
3-7 . . Light
7-14. . Threatening
28 and over - Very severe

GRASSHOPPER POPULATIONS BY DISTRICTS, 1978

District	Average number of grasshoppers per square yard
Northwest	1.4
Northeast	0.3
West	7.0
Central	1.8
East	1.8
West-southwest	2.5
East-southeast	2.6
Southwest	2.5
Southeast	2.1

VEGETABLE CULTIVAR TRIALS

J. W. Courter and C. M. Sabota

Commercial growers and gardeners can often improve yield, time of harvest maturity, quality, and disease resistance by selection of proper cultivars. This is a report of cultivars evaluated in 1978 for adaptability to Illinois.

Methods. New vegetable cultivars of selected vegetables were grown at the Dixon Springs Agricultural Center. The soil is Grantsburg silt loam and the plots were irrigated as needed. Rainfall was erratic during the 1978 growing season. By mid-August rainfall at the Center was 12 inches below normal. The planting dates, plant and row spacings, and harvest dates accompany Tables 1 through 4. Seed sources are given on page 41.

Results. The yields and performance of caged tomatoes, sweet corn and watermelons are given in Tables 1 to 4. For comparison with previous years see pages 39-51 of the Proceedings of the 1978 *Illinois Vegetable Growers Schools*.

The following new cultivars are worthy of grower testing based on performance in these trials, especially in the southern half of Illinois. See pages 90-103 for recommended varieties and other trial suggestions.

Muskmelon: G-25VG, Star Trek

Tomato: Floramerica (local market), Show-Me, Sunripe, Main Pak, Floradade, Royal Flush, Westover, Traveler 76

Sweet corn: (also see pages 42-56), Florida Stay Sweet, Honeycomb, Bellringer, Cherokee, XP-370

Watermelon: Yellow Baby (early, local market)

Reference

1. Courter, J. W. 1978. Vegetable cultivar trials. Proc. 1978 Illinois Vegetable Growers Schools. Univ. Ill. Dept. Hort. Series 5:39-51.

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TABLE 1. YIELD AND FRUIT SIZE OF TOMATO CULTIVARS, 1978

Dixon Springs Agricultural Center

Cultivar[1]	Source	Early yield[2]	Total yield[2] No. 1	Total yield[2] Mkt.	Fruit size	Culls Total	Culls BER[3]	Notes[4]
		(lb/pl)	(lb/pl)		(oz)	(no/pl)		
Floramerica	UF	1.9	10.9	14.5	7.5	6	1	SD, Firm
Royal Flush	T	2.5	10.4	18.7	6.1	4	1	D
Pink Panther	BA	1.3	10.0	13.2	5.7	13	5	SD
Traveler 76	T	1.0	8.9	12.9	4.4	2	0	GS, Firm
Westover	UMY	0.8	7.7	10.9	6.8	1	0	SD, Firm
Show-Me	C	2.4	7.3	10.8	6.4	21	7	Firm
Calypso	UF	2.4	7.1	14.8	6.9	6	1	D
Red Pak	H	1.6	7.1	11.9	5.9	7	2	D, Firm
Jet Star	H	1.2	6.9	10.7	5.6	4	1	
Floradade	UF	1.0	6.5	12.5	5.0	6	0	G
Sunripe	BA	2.8	6.2	14.5	5.5	6	0	D
Mainpak	H	1.4	6.2	10.2	7.6	13	5	Firm
Big Girl	BUR	0.5	6.1	9.6	6.1	9	4	GS
Traveler	T	0.9	5.7	10.1	4.2	4	0	
Supersonic B	H	1.6	5.5	9.4	5.5	10	3	GS
Supersonic	H	1.3	5.3	9.4	6.6	9	3	C
September Dawn	H	0.3	5.0	8.3	5.7	2	0	
Burpee's VF	BUR	1.5	5.0	8.2	5.7	13	5	GS
He-Man	G	1.0	4.1	9.4	6.7	11	3	C
Better Boy	BA	1.5	4.1	7.4	5.6	12	3	C
Super Fantastic	BA	2.0	3.7	15.4	5.5	22	5	GS, C
Henry Field Hyb.	HF	1.4	2.6	8.7	4.8	16	2	FW, C, GS
NFV-22	H	0.5	2.4	5.7	5.5	3	0	D, GS
HY-X	HF	3.2	1.5	5.9	5.9	17	1	FW,D,C,CF
Early Cascade	P	1.6	1.5	5.7	2.6	1	0	SD
Beefeater	SS	0.7	1.2	3.1	12.0	13	3	RF, CF
Bragger	G	1.0	0.9	14.2	15.4	6	0	FW, CF, GS
Jubilee	BUR	0.0	0.9	2.8	6.7	16	7	FW, SD, GS
Delicious	BUR	0.2	0.6	6.8	14.0	4	0	FW,RF,GS,CF,C

[1]Seeded April 25, 1978; transplanted May 22, 1978; spacing 6 x 2 feet; grown in 2-1/2 ft wire cages.
[2]Early yield--July 21 to July 31, 1978; total yield--July 21 to August 24, 1978.
[3]BER = blossom end rot.
[4]Abbreviations: C = fruit cracking; CF = catfacting; FW = fusarium wilt; D = determinate; G = graywall; SD = semideterminate; GS = green shoulder; RF = rough fruit.

TABLE 2. OBSERVATION OF SWEET CORN CULTIVARS, 1978

Dixon Springs Agricultural Center

Cultivar[1]	Source	Date of first harvest	Ear characteristics: Length	Ear characteristics: Tip cover[2]	Ear characteristics: Weight 6 ears	Comments
			(in)		(lb)	
Aztec	A	7/19	7.5	G	3.5	
Reliance	NK	7/24	7.5	G	3.7	
Early Northern Giant	GU	7/24	7.25	G	4.1	Poor ear fill
Comet[3]	A	7/27	8.5	G	3.6	
W9625	H	7/27	8.75	G	4.0	
Bellringer	H	7/27	7.0	G	4.1	
Kandy Korn[3]	SS	7/28	8.25	F	3.7	
Sundance	H	7/28	7.25	F	4.2	
Comanche	A	7/28	8.5	G	3.5	
Slendergem	S	7/28	9.5	G	3.3	
Dawn	NK	7/28	7.25	F	3.4	Poor ear fill
Exp. 4798	NK	8/01	8.5	F	3.4	
Omega	NK	8/01	8.25	F	3.7	
Exp. 2583	NK	8/01	9.0	G	4.3	
74-3044	R	8/01	9.75	G	4.1	
Starlet	S	8/01	9.0	P	4.7	
Sunshine State	K	8/01	8.5	G	4.0	
Tri-Gold	SS	8/01	7.75	G	4.1	
XP-2500	A	8/01	8.25	G	4.8	
XP-370	A	8/01	8.5	G	4.5	
XP-2505	A	8/01	8.75	G	5.2	
Cherokee	A	8/01	8.25	G	4.6	
Quicksilver	H	8/01	7.5	G	4.2	Smut
76-2944	R	8/01	8.5	G	4.3	
Sweet Sal	H	8/01	7.25	G	4.5	Big kernel
BiQueen	R	8/02	7.25	G	3.7	
Style Pak	SS	8/04	8.5	G	4.0	
Candyman	K	8/06	7.75	G	4.3	
WH-1235[3]	H	8/08	8.25	F	3.8	Smut; bi-color
207	H	8/08	7.5	G	3.8	
Sweet Tennessee	K	8/08	7.5	G	4.1	
Capitan	A	8/08	9.25	G	4.6	
Exp. 2403	NK	8/08	8.0	F	4.9	
XP-2527	A	8/08	8.25	G	4.4	
Commander	A	8/08	8.5	P	4.8	
Lancer	S	8/11	8.5	G	4.3	

[1]Planted: 05/29/78.
[2]Tip cover ratings: G = good, F = fair, P = poor.
[3]Planted: 05/26/78.

TABLE 3. PERFORMANCE OF SWEET CORN CULTIVARS, 1978

Dixon Springs Agricultural Center

Cultivar[1]	Source	Date of first harvest	Ear characteristics Length	Tip cover[2]	Weight 6 ears	Projected yield[3]
			(in)		(lb)	(doz/A)
Early Extra Sweet	I	7/24	8.5	G	4.8	1,002
Xtra Sweet 77	I	7/24	7.75	P	4.6	607
Honeycomb	NK	7/28	9.25	G	4.4	1,095
Sugar Loaf	NK	7/28	8.0	P	3.7	750
Illini Xtra Sweet	I	7/28	8.5	P	3.6	504
NK 199	NK	8/01	8.0	G	4.4	1,036
Jubilee[4]	R	8/01	8.75	P	3.9	994
Florida Stay Sweet	I	8/01	7.75	G	4.3	807
Merit[4]	A	8/01	8.75	G	4.3	654
Silver Queen	R	8/06	8.87	G	4.7	956
Golden Queen[4]	R	8/06	8.25	G	4.5	840

[1]Planted: 05/26/78.
[2]Tip cover ratings: G = good, P = poor.
[3]Harvested by U-pick customers.
[4]Planted: 05/29/78.

TABLE 4. PERFORMANCE OF WATERMELONS, 1978

Dixon Springs Agricultural Center

Cultivar[1]	Source	Early yield[2]	Late yield[2]	Total yield		Melon size
				No.	Weight	
		(no/plot)	*(no/plot)*	*(no/plot)*	*(lb)*	*(lb)*
Triple Sweet	AS	1	60	61	1013	16.6
Seedless Hyb. 313	AS	18	37	55	886	16.1
Sweet Princess	T	21	26	47	776	16.5
Exp. Hyb. #20	AS	20	33	53	631	11.9
Yellow Baby[3]	KY	57	15	72	446	6.2
Kengarden	P	2	14	16	110	6.9

[1]Seeded 05/05/78; transplanted 05/22/78. Spacing: rows 12' apart, plants 5' apart; 16 plants per plot. All rows mulched with 1.5 mil black polyethylene 4' wide.
[2]Early: 07/21 to 08/04/78; Late: 08/09 to 08/31/78.
[3]Approximately 50 percent of Yellow Baby was harvested prior to July 31. No other cultivar matured prior to that date.

SEED SOURCES

We gratefully acknowledge the following companies and universities for seed used in these trials. Inclusion or exclusion of companies in this list does not constitute a recommendation.

Code	Source and address
A	Asgrow Seed Co., Kalamazoo, MI 49001
AG	Agway, Inc., Box 1333, Syracuse, NY 13201
AS	American Seedless Watermelon Seed Corp., Goshen, IN 46526
BA	Geo. J. Ball, Inc., Box 335, West Chicago, IL 60185
BUR	W. Atlee Burpee Co., Box B-2001, Clinton, IA 52732
C	A. L. Castle, Inc., Box 877, Morgan Hill, CA 95037
CR	Crookham Company, Box 520, Caldwell, ID 83605
FC	FMC Corp. (Niagara Brand), see N
FM	Ferry-Morse Seed Co., Inc., Mountain View, CA 94040
G	Goldsmith Seeds, Inc., Gilroy, CA 95020
GU	Gurney Seed Co., Yankton, SD 57679
H	Joseph Harris Co., Inc., Moreton Farms, Rochester, NY 14624
HF	Henry Field Seed & Nursery Co., Shenandoah, IA 51601
I	Illinois Foundation Seeds, R-1, Tolono, IL 61880
K	Keystone Seeds, Hollister, CA 95023
KY	Known-You Seed Co., 26 Chung Cheng 2nd Road, Kaohsiung, Taiwan
N	Niagara Seeds, FMC Corp., Seed Dept., Box 3091, Modesto, CA 95353
NK	Northrup King & Co., 1500 Jackson St., N.E., Minneapolis, MN 55413
P	Geo. W. Park Co., Inc., Greenwood, SC 29646
PS	Petoseed Co., Inc., Box 4206, Saticoy, CA 93003
R	Rogers Brothers Seed Co., Box 2188, Idaho Falls, ID 83401
RS	Robson Seed Farms Corporation, Hall, NY 14463
S	Seedway, Inc., Hall, NY 14463
SS	Stokes Seeds, Inc., Box 548, Buffalo, NY 14240
T	Otis S. Twilley, Box 1817, Salisbury, MD 21801
UF	University of Florida, Gainesville, FL 32601
UMY	University of Maryland, College Park, MD 20740

1978 SWEET CORN TRIALS AND EVALUATION FOR TOLERANCE TO MDMV

A. M. Rhodes, C. C. Doll, B. J. Jacobsen, M. A. Mikel, C. J. D'Arcy, L. R. Nelms, R. E. Ford, and W. L. George

Maize dwarf mosaic virus (MDMV), and to a lesser extent wheat streak mosaic virus (WSMV), have become serious in sweet corn in midwestern and eastern states during the past two years. In 1977, many commercial fields of sweet corn had to be abandoned due to losses caused by one or both of these viruses. A cooperative project was initiated in 1978 by the Departments of Horticulture and Plant Pathology to test sweet corn cultivars for fresh market characteristics and for tolerance to MDMV.

Methods. Sixty-one cultivars were grown at four locations: Urbana, Rochelle, Collinsville, and the Illinois River Sand Field at Kilbourne (Tables 1 to 6). Twenty cultivars were evaluated in replicated trials (Tables 1,4,5) and 41 in single row observation (Tables 2,3,6). The trial at Urbana was inoculated with MDMV (Strain B). The trial at Rochelle was naturally infected with MDMV (Strain A). Natural virus infection was not detected in the trials at Collinsville or Kilbourne. Information on planting dates, spacing, and other treatments accompany the tables.

Results. The most important criterion for judging lack of tolerance to MDMV-B was poor kernel set at the butt of the ear (butt blanking). Butt blanking (missing kernels) was usually found on the side of the ear facing the stalks. Overall ear appearance was impaired. Other obvious effects of MDMV-B infection was a delay in silking, reduced plant height, and smaller ear size and diameter. The reduced ear diameter may be partly due to the delay in silking since the paired samples (control versus inoculated) were harvested on the same date, not the same number of days after silking. See pages 71-73 for additional information on the effects of virus infection on sweet corn.

The hybrids rated 80 to 100 for ears with no butt blanking were considered highly tolerant to MDMV (Strain B) based on data from the Urbana trial (Tables 1,2). Among these 27 tolerant hybrids, however, other undesirable characteristics were noted: (1) smut, especially prevalent for the early cultivars; (2) ear tip blanking; (3) husk cover, marginal to poor; and (4) overall ear appearance, marginal to poor.

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Undesirable characteristics observed in 1978 Urbana trials.

Too much smut (80% or more): Earlibelle, Harmony, H12166, Spring White, Sundance, and Wintergreen

Poor husk cover: Golden Gleam, Resister (rated good at Collinsville), and Wintergreen

Ear tip blanking (10mm or more): Bi-Queen, Comet (inoculated sample only), NCX 2020 and XP 833701 (sh2 kernel, some smut, not sold in Illinois).

Poor appearance: EH 207 (glumes in ear tip), Foremost (overall poor pollination) and NCX 2020 (unattractive ears).

Other notes: Cherokee (long shank, pulls hard)
Early Fortune (not sold in Illinois)
Seneca Star (some smut)
Spring Gold (some smut)

Overall, the best MDMV tolerant entries were:

Early: Seneca Star, Spring Gold

Mid-season: Cherokee, Comet (white) H 445, Merit, NCX 2009, Resister (?), Sugar Loaf, XP 370

Late: Golden Queen, H74-3045, Silver Queen, White Lightning

Other suitable entries for the fresh market under conditions of no MDMV infection were (Tables 4,5,6): Sundance (early) and Gold Cup, Bellringer and Seneca Scout (mid-season). Also see the references and pages 90-93 for additional information on sweet corn.

References

Rhodes, A. M. 1978. Sweet corn varieties--today and tomorrow. Proc. 1978 Illinois Vegetable Growers Schools. Univ. Ill. Dept. Hort. Series 5:10-12.

Rhodes, A. M. and B. J. Jacobsen. 1978. List of sweet corn cultivars of possible merit for Illinois fresh market growers. Proc. 1978 Illinois Vegetable Growers Schools. Univ. Ill. Dept. Hort. Series 5:13-16.

Jacobsen, B. J. 1978. Sweet corn diseases: Biology of pathogens and an integrated control program. Proc. 1978 Illinois Vegetable Growers Schools. Univ. Ill. Dept. Hort. Series 5:17-23.

TABLE 1. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Replicated Trial

				Ear characteristics[3]								
Cultivar	Source	MDMV[2]	Days to 50% silk	Butt fill[4]	Length	Dia.	Weight first ear	Total yield Weight	Total yield Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	(mm)	(lb)	(lb)	(no)		(cm)	
Aztec	A	C	45.7	100	206	46.7	2.94	2.94	5.0	1.0	166	24.3
		V	46.0	60*[6]	193	45.0*	2.50*	2.50	5.0	2.3*	166	24.0
Sundance	H	C	47.0	100	199	47.0	2.98	2.98	5.0	1.0	132	26.0
		V	47.3	80	194	47.0	2.79	2.79	5.0	1.3	130	25.7
H 12266	H	C	53.0	100	217	49.3	3.46	3.46	5.0	1.3	173	24.0
		V	54.7*	60*	208*	47.0*	2.90*	2.90	5.0	2.0*	166	22.3*
Gold Cup	H	C	53.7	100	183	46.0	2.63	4.06	8.0	1.0	185	26.3
		V	54.7*	20*	185	45.0	2.36*	3.40	7.3	2.7*	174*	25.3*
Wintergreen	A	C	54.3	100	218	45.0	2.90	2.90	5.0	1.7	183	25.0
		V	54.3	80	218	44.3	2.83	2.83	5.0	1.7	172*	25.0
H 12166	H	C	54.7	100	203	48.7	2.94	3.27	5.7	2.0	156	25.3
		V	56.0*	100	195*	46.7*	2.64*	3.14	6.0	2.3	156	24.0*
Resister	FC	C	54.7	100	230	52.7	4.08	4.08	5.0	1.0	200	25.3
		V	54.7	80	230	49.7*	3.50*	3.50	5.0	1.3	200	25.3
Bellringer	H	C	55.0	100	195	48.3	2.94	3.10	5.3	1.0	172	25.0
		V	56.0*	67*	195	45.7*	2.65*	2.79	5.3	1.3	163*	24.0*

(continued)

TABLE 1. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Replicated Trial
(continued)

				Ear characteristics[3]							
Cultivar	Source	MDMV[2]	Days to 50% silk	Butt fill[4]	Length	Dia.	Weight first ear	Total yield Weight	Total yield Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	(mm)	(ℓb)	(ℓb)	(no)		(cm)	
Cherokee	A	C	55.0	100	213	43.3	2.71	3.96	7.3	1.0	200	25.0
		V	56.0*	93	218	43.0	2.69	2.81*	5.3*	1.0	196	24.0*
Seneca Scout	H	C	55.0	100	193	44.7	2.40	3.69	7.3	1.3	197	25.0
		V	56.7*	53*	188	41.7*	2.23	2.63*	6.0*	2.0*	188*	23.3*
XP 370	A	C	55.0	100	223	48.0	3.29	3.29	5.0	1.0	177	25.0
		V	56.3*	80	223	44.7*	2.92	3.23	5.7	1.7*	172	23.7*
Lancer	S	C	55.3	100	215	45.7	2.83	3.33	6.0	1.7	185	24.7
		V	57.0*	0*	212	42.0*	2.33*	2.48*	5.3	3.0*	177*	23.0*
Sugar Loaf	NK	C	55.3	100	205	47.7	3.09	4.15	7.0	1.0	187	24.7
		V	58.0*	87	202	46.0*	2.73*	3.44	6.3	1.3	185	22.0*
Bonanza	FM	C	55.7	100	233	45.3	3.13	3.13	5.0	1.3	183	24.3
		V	57.0*	53*	227	44.3	2.88*	2.88	5.0	2.0*	183	23.0*
Enterprise	CR	C	57.0	100	222	48.7	3.27	4.00	6.3	1.0	192	25.0
		V	58.0*	53*	215	48.0	3.02*	3.02*	5.0*	1.0	188	24.0*
Florida Stay Sweet	I	C	57.3	100	200	48.0	3.02	3.21	5.3	1.0	170	31.7
		V	59.0*	53*	200	47.3	3.12	3.27	5.7	1.0	165	30.0*

(continued)

TABLE 1. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Replicated Trial
(continued)

				Ear characteristics[3]								
								Total yield				
Cultivar	Source	MDMV[2]	Days to 50% silk	Butt fill[4]	Length	Dia.	Weight first ear	Weight	Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	*(mm)*	*(lb)*	*(lb)*	*(no)*		*(cm)*	
H74-3044	R	C	58.0	100	210	49.3	3.40	3.71	5.7	1.0	177	24.0
		V	59.0*	13*	183*	45.0*	2.19*	2.19*	5.0	3.0*	156*	23.0*
Capitan	A	C	58.7	100	235	43.7	2.98	2.98	5.0	1.0	190	23.3
		V	59.7*	53*	232	43.7	2.92	2.92	5.0	1.0	190	22.3*
Golden Gleam	H	C	59.7	100	223	47.3	3.21	3.73	6.0	1.0	202	26.7
		V	60.3	100	218	47.0	3.17	3.48	5.7	1.0	197	26.0
Silver Queen	R	C	62.3	100	212	48.7	3.44	3.44	5.0	1.0	194	26.7
		V	62.7	93	207	47.3	3.41	3.41	5.0	1.0	185*	26.3

[1]Planted 05-26-78. Spacing 38" between and 13" within rows. Split-plot design with cultivars as main plots and treatments as sub-plots. Sub-plots, were paired rows (see footnote 2) with border rows. Three replications of each treatment.
[2]Treatment: C = control; V = MDMV (Strain B) inoculated June 9, reinoculated symptomless plants June 19. Inoculum consisted of .01M Na_2PO_4 buffer pH 7.0 (1:4 W/V) with the infected plant sap and 15 g/1 carborundum.
[3]Data are means of five ears per plot.
[4]Percent of ears with no butt blanking.
[5]Rating for overall ear appearance: 1 = marketable; 2 = marginal; 3 = not acceptable.
[6]Inoculated means in columns (within cultivars) significantly different from the control at 5%, l.s.d. test.

TABLE 2. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Single Row Observations

Cultivar	Source	MDMV[2]	Days to 50% silk	Ear characteristics[3]: Butt fill[4]	Length	Dia.	Weight first ear	Total yield: Weight	Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	(mm)	(lb)	(lb)	(no)		(cm)	
XP 833701	AG	C	45	100	175	43	2.13	2.13	5.0	3.0	107	25
		V	47	80	175	44	2.25	2.25	5.0	3.0	107	23
Spring Gold	H	C	45	100	190	46	2.56	2.56	5.0	1.0	125	25
		V	45	80	180	46	2.44	2.44	5.0	1.0	111	25
Spring White	H	C	45	100	180	47	2.75	2.75	5.0	1.0	118	25
		V	45	100	182	49	3.19	3.19	5.0	1.0	109	25
Seneca Star	RS	C	45	100	220	47	3.38	3.38	5.0	1.0	132	25
		V	45	80	190	49	3.00	3.00	5.0	2.0	130	25
Earlibelle	H	C	47	100	210	48	3.25	3.25	5.0	1.0	135	26
		V	47	100	190	48	2.56	2.56	5.0	1.0	135	26
Butter Corn	AG	C	48	100	190	46	2.69	2.69	5.0	2.0	128	25
		V	48	60	165	46	2.25	2.25	5.0	3.0	122	25
Early Fortune	AG	C	48	100	190	44	2.50	2.50	5.0	1.0	114	25
		V	48	100	190	44	2.50	2.50	5.0	1.0	114	25
Harmony	H	C	49	100	190	50	3.19	3.19	5.0	1.0	152	24
		V	50	80	190	50	2.50	2.50	5.0	1.0	134	23

(continued)

TABLE 2. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Single Row Observations
(continued)

Cultivar	Source	MDMV[2]	Days to 50% silk	Ear characteristics[3] Butt fill[4]	Length	Dia.	Weight first ear	Total yield Weight	Total yield Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	(mm)	(ℓb)	(ℓb)	(no)		(cm)	
NCX 2020	N	C	52	100	210	50	3.19	3.19	5.0	2.0	165	25
		V	52	100	205	47	2.56	2.56	5.0	3.0	155	25
Quick Silver	H	C	52	100	195	48	2.75	2.75	5.0	3.0	150	25
		V	53	40	185	45	2.44	2.44	5.0	3.0	140	24
Slendergem	S	C	52	100	220	41	2.56	2.56	5.0	2.0	155	25
		V	53	40	220	40	2.31	2.31	5.0	2.0	150	24
Foremost	FM	C	53	100	220	48	3.56	3.56	5.0	2.0	180	24
		V	55	80	220	45	3.06	3.06	5.0	2.0	170	22
Pageant	R	C	53	100	205	51	3.44	3.44	5.0	1.0	165	24
		V	54	20	205	46	2.75	2.75	5.0	3.0	165	23
Burgundy Delight	S	C	53	100	205	45	2.63	2.63	5.0	2.0	175	24
		V	56	60	205	42	2.13	2.13	5.0	3.0	168	21
XP 833702	AG	C	54	100	190	46	2.56	2.56	5.0	1.0	194	26
		V	54	60	190	44	2.44	2.44	5.0	2.0	180	26

(continued)

TABLE 2. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Single Row Observations
(continued)

				Ear characteristics[3]								
								Total yield				
Cultivar	Source	MDMV[2]	Days to 50% silk	Butt fill[4]	Length	Dia.	Weight first ear	Weight	Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	(mm)	(ℓb)	(ℓb)	(no)		(cm)	
Starlet	S	C	54	100	230	46	3.38	4.00	6.0	2.0	170	26
		V	54	60	215	45	3.00	3.00	5.0	2.0	170	26
Comet	A	C	55	100	220	46	3.13	3.13	5.0	1.0	194	25
		V	55	100	220	44	2.56	2.56	5.0	2.0	194	25
NCX 2009	N	C	55	100	220	48	3.19	3.19	5.0	1.0	190	25
		V	56	100	220	47	2.81	2.81	5.0	2.0	178	24
Sweet Sal	H	C	55	100	210	45	2.75	2.75	5.0	1.0	162	25
		V	56	60	215	44	2.44	2.44	5.0	2.0	152	24
Salute	A	C	56	100	210	46	3.06	3.06	5.0	1.0	162	24
		V	58	40	200	44	2.38	2.38	5.0	3.0	157	22
XP 2527	A	C	56	100	240	46	3.19	3.19	5.0	1.0	171	24
		V	58	40	230	43	2.69	2.69	5.0	2.0	166	22
Gold Crown	H	C	56	100	225	45	2.88	2.88	5.0	3.0	174	24
		V	58	0	230	47	3.19	3.19	5.0	3.0	172	26
EH 207	H	C	56	100	185	44	2.13	2.13	5.0	3.0	172	24
		V	56	80	195	42	2.25	2.25	5.0	3.0	159	24

(continued)

TABLE 2. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Single Row Observations
(continued)

Cultivar	Source	MDMV[2]	Days to 50% silk	Ear characteristics[3]: Butt fill[4]	Ear characteristics[3]: Length	Ear characteristics[3]: Dia.	Ear characteristics[3]: Weight first ear	Ear characteristics[3]: Total yield Weight	Ear characteristics[3]: Total yield Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	(mm)	(ℓb)	(ℓb)	(no)		(cm)	
EXP 2403	NK	C	56	100	210	49	3.44	3.44	5.0	2.0	176	24
		V	58	0	210	46	2.69	2.69	5.0	2.0	166	22
Seneca Chief	RS	C	56	100	220	42	2.44	2.44	5.0	1.0	157	24
		V	58	60	200	38	1.81	1.81	5.0	2.0	157	22
Jubilee	R	C	56	100	210	48	3.00	3.00	5.0	1.0	178	24
		V	56	40	215	44	2.63	2.63	5.0	1.0	174	24
Sweet Sue	H	C	57	100	200	43	2.69	2.69	5.0	2.0	168	25
		V	58	40	200	45	2.75	3.69	7.0	2.0	162	26
H 445	H	C	57	100	200	43	2.56	3.06	6.0	1.0	200	25
		V	58	100	190	42	2.31	2.75	6.0	1.0	190	24
Golden 80	AG	C	58	100	210	45	2.81	4.56	8.0	2.0	157	24
		V	58	40	210	44	2.75	3.13	6.0	2.0	157	24
Merit	H	C	58	100	220	49	3.63	3.63	5.0	1.0	192	24
		V	58	100	220	50	3.50	3.50	5.0	1.0	192	24
Hallmark	NK	C	58	100	220	52	3.25	3.25	5.0	3.0	180	24
		V	58	20	220	50	3.25	3.25	5.0	3.0	171	24

(continued)

TABLE 2. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Single Row Observations
(continued)

				Ear characteristics[3]								
Cultivar	Source	MDMV[2]	Days to 50% silk	Butt fill[4]	Length	Dia.	Weight first ear	Total yield Weight	Total yield Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	*(mm)*	*(lb)*	*(lb)*	*(no)*		*(cm)*	
RXP 243	RS	C	58	100	200	45	2.69	2.69	5.0	2.0	164	24
		V	60	40	195	41	2.31	2.31	5.0	2.0	154	22
White Lightning	CR	C	58	100	200	41	2.44	2.44	5.0	1.0	200	24
		V	60	100	200	42	2.56	2.56	5.0	1.0	200	22
RXP 214	RS	C	60	100	210	47	3.25	4.25	7.0	1.0	200	27
		V	61	20	205	43	2.63	2.63	5.0	3.0	200	26
Bi-Queen	R	C	61	100	210	48	3.31	3.31	5.0	1.0	170	26
		V	63	100	210	47	3.19	3.19	5.0	1.0	170	24
H74-3045	R	C	61	100	210	48	3.31	3.31	5.0	1.0	174	26
		V	65	100	210	48	3.19	3.19	5.0	1.0	165	22
WH 1235	H	C	62	100	220	44	2.81	3.31	6.0	1.0	186	25
		V	64	60	210	44	2.69	2.69	5.0	1.0	186	23
Golden Queen	R	C	62	100	215	46	3.00	3.00	5.0	1.0	185	25
		V	63	100	215	45	2.81	2.81	5.0	1.0	185	24

(continued)

TABLE 2. MAIZE DWARF MOSAIC (STRAIN B) SWEET CORN TRIAL, URBANA, 1978[1]
Single Row Observations
(continued)

Cultivar	Source	MDMV[2]	Days to 50% silk	Ear characteristics[3] Butt fill[4]	Length	Dia.	Weight first ear	Total yield Weight	Ears	Rating[5]	Plant height	Days from silk to harvest
					(mm)	*(mm)*	*(lb)*	*(lb)*	*(no)*		*(cm)*	
Patriot	R	C	62	100	215	48	3.19	3.19	5.0	1.0	185	25
		V	65	20	210	46	2.81	2.81	5.0	2.0	165	22
Silver Queen	H	C	64	100	210	46	3.06	3.06	5.0	1.0	182	25
		V	66	100	210	48	3.38	3.38	5.0	1.0	182	23
WH 616	H	C	64	100	205	46	2.88	2.88	5.0	1.0	170	25
		V	65	40	190	42	2.38	2.38	5.0	3.0	170	24

[1]Planted 05-26-78. Spacing 38" between and 13" within rows. Split-plot design with cultivars as main plots and treatments as sub-plots. Sub-plots were paired rows (see footnote 2) with border rows. Three replications of each treatment.

[2]Treatment: C = control; V = MDMV (Strain B) inoculated June 9, reinoculated symptomless plants June 19. Inoculum consisted of .01M Na_2PO_4 buffer pH 7.0 (1:4 W/V) with the infected plant sap and 15 g/1 carborundum.

[3]Data are means of five ears per plot.

[4]Percent of ears with no butt blanking.

[5]Rating for overall ear appearance: 1 = marketable; 2 = marginal; 3 = not acceptable.

TABLE 3. MDMV (Strain A) RATINGS
Rochelle Sweet Corn Trial, 1978[1]

Cultivar	Rating[2]	Cultivar	Rating[2]
Sweet Sal	100/8	XP 2527	100/5
Sweet Sue	100/8	Bonanza	100/5 (4 pl)
Fl. Stay Sweet	100/8	NCX 2009	100/5
		NCX 2020	100/5
		Bellringer	100/5
		Sugar Loaf	100/5
Cherokee	100/7	Pageant	100/5
XP 370	100/7	H 74-3045	100/5
EH 207	100/7	Lancer	100/5
WH 616	100/7	Golden Gleam	100/5 (1 pl)
WH 1235	100/7		
Seneca Chief	100/7	Slendergem	100/4
RXP 214	100/7	Enterprise	100/4
RXP 243	100/7		
Gold Queen	100/7	Spring White	100/3
		Spring Gold	100/2
Comet	100/6	Gold Cup	90/7
Foremost	100/6 (1 pl)		
Resister	100/6	Capitan	80/7
Gold Crown	100/6	Merit	80/7
H 12266	100/6		
Hallmark	100/6	Sundance	80/4
EXP 2403	100/6		
Bi-Queen	100/6	Harmony	70/5
Jubilee	100/6		
Patriot	100/6	H 12166	70/4
Silver Queen	100/6		
H 74-3044	100/6	Seneca Star	70/3
Burgundy Delight	100/6		
Seneca Scout	100/6	Quicksilver	60/6
Silver Queen	100/6		
Starlet	100/6	Salute	50/5
White Lightning	100/6 (3 pl)	Wintergreen	50/5
H445	100/6		
		Aztec	50/4

[1]Planted mid-June. A natural epidemic of MDMV-A occurred in late June and July.
[2]Rated August 16. Visual rating of the percentage of plants infected/and symptom severity. The severity ratings on score of 1 to 10 with 10 most severe.

TABLE 4. SWEET CORN TRIAL, COLLINSVILLE, 1978

Cultivar[1]	Days to 50% silk	Ear characteristics[2] Height	Length	Diameter	Date of harvest	Marketable ears[2] Yield	Weight[3]	Comments
		(cm)	(mm)	(mm)		(no)	(lb)	
Aztec	44	64	203	41	7/17	19.0	2.07	Poor quality
Sundance	46	46	196	43	7/18	21.0	2.04	Average for variety
Wintergreen	51	65	221	41	7/26	24.0	2.38	Long, tapered ear, uneven fill, poor tip
Bellringer	51	58	191	46	7/26	20.3	2.54	Suckers, good quality, short plant
Gold Cup	51	69	185	46	7/26	27.0	2.26	Normal appearance and yield
H 12166	52	58	196	46	7/26	13.7	2.51	Open tip, 20% smut, poor quality
H 12266	51	58	203	48	7/26	21.0	3.65	Good tip cover, 10% smut, poor texture
Sugar Loaf	56	75	201	46	7/27	26.0	2.57	Attractive ear, open tip
Cherokee	54	72	201	43	7/28	22.1	2.54	Good tip cover, pulls hard
XP 370	52	69	203	43	7/28	20.3	2.66	Pointed tip, pulls easy
Bonanza	55	81	221	46	7/28	23.0	2.88	Uneven fill, uneven maturity
Resister	54	91	229	48	7/28	30.0	3.65	Attractive, good tip cover fair flavor
H 74-3044	57	86	201	46	7/28	24.3	2.79	Tall plant, suckers
Lancer	52	65	211	43	7/28	19.7	2.82	Fair cover, long slender ear
Enterprise	54	81	208	46	7/28	26.3	2.94	Tip not filled, attractive ear, uneven maturity
Golden Gleam	56	91	218	43	7/28	28.8	2.63	Open tip, good flavor, some smut, hard to shuck
Fl. Stay Sweet	53	80	193	48	7/31	25.0	2.88	Poor tip cover
Seneca Scout	55	86	183	48	8/01	28.7	3.00	Attractive
Silver Queen	57	91	203	46	8/02	24.5	2.69	
Capitan	56	85	229	43	8/03	26.0	2.94	Fair tip cover
L.S.D. 5%		6.5	8.1			5.7	0.13	
1%		8.7	10.9			7.6	0.18	

[1]Planted May 18, 1978.
[2]Mean of three replications, each plot 20 plants.
[3]Weight of five ears out of shuck.

TABLE 5. SWEET CORN TRIAL, ILLINOIS RIVER VALLEY SAND FARM, 1978
Replicated Trial

Cultivar[1]	Source	Days to 50% silk[1]	Ear characteristics[2] Length (mm)	Diameter (mm)	Weight (lb)
Sundance	H	63	178	39.0	1.80
Aztec	A	64	182	36.3	1.53
Wintergreen	A	70	203	36.0	1.77
Bellringer	H	70	181	39.7	1.93
H 12266	H	70	196	40.7	2.17
Cherokee	A	71	196	39.7	2.00
Bonanza	FM	71	212	45.0	2.50
Gold Cup	H	71	175	38.0	1.60
Resister	N	72	218	48.0	3.00
XP 370	A	73	198	40.0	1.83
Lancer	S	73	185	37.7	1.63
Enterprise	CR	73	197	43.3	2.20
Seneca Scout	RS	74	181	38.3	1.63
Capitan	A	75	209	40.3	2.03
Fl. Stay Sweet	I	75	192	38.7	1.77
Sugar Loaf	NK	75	191	43.0	2.23
H74-3044	R	75	193	46.0	2.70
H 12166	H	78	182	38.3	1.60
Silver Queen	R	78	206	45.0	2.60
LSD 5% (1%)			12(16)	3.1(4.3)	.39(.53)

[1]Planted April 27.
[2]Plots 15 feet long, harvested once, data are means of three replications for the best five ears removed from the husk.

TABLE 6. SWEET CORN TRIAL, ILLINOIS RIVER VALLEY SAND FARM, 1978
Single Row Observations

Cultivar[1]	Source	Days to 50% silk[1]	Ear characteristics[2] Length		
			Length	Diameter	Weight
			(mm)	(mm)	(lb)
Early Fortune	AG	63	180	38	1.6
Earlibelle	H	63	189	38	1.8
Butter Corn	AG	64	183	38	1.8
Harmony	H	64	181	38	1.7
Seneca Star	RS	64	192	37	1.8
XP 833701	AG	66	179	36	1.5
Spring Gold	H	66	148	34	1.1
Spring White	H	66	153	38	1.2
NCX 2020	FC	68	193	39	2.0
Slendergem	S	68	228	34	2.0
XP 833702	AG	70	189	41	2.1
Foremost	FM	70	204	42	2.3
Quicksilver	H	70	173	42	1.9
Pageant	R	70	178	39	1.6
Starlet	S	70	210	45	2.6
Merit	A	71	207	45	2.7
Gold Crown	H	71	198	41	2.0
EH 207	H	71	168	40	1.8
Jubilee	R	71	186	42	1.8
Seneca Chief	RS	72	204	38	2.1
NCX 2009	FC	73	194	45	2.3
XP 2527	A	74	204	43	2.4
Golden 80	AG	75	206	43	2.1
Comet	A	75	207	44	2.4
Salute	A	75	178	45	1.7
EXP 2403	NK	75	204	42	2.3
Burgundy Delight	S	75	196	37	1.8
WH 1235	H	78	198	38	1.8
RXP 214	RS	78	207	45	2.7
RXP 243	RS	78	186	41	2.2
Sweet Sal	H	80	180	40	1.7
Sweet Sue	H	80	189	43	1.9
WH 616	H	80	195	41	2.2
Bi-Queen	R	80	200	40	2.1
H74-3045	R	80	205	47	2.8
Silver Queen	H	81	198	40	2.3
Golden Queen	R	81	187	40	2.0
Patriot	R	81	173	41	1.6
White Lightning	CR	82	152	41	1.7

[1]Planted April 27.
[2]Data are recorded for the best five ears harvested from single row plots, 15 feet long.

STORAGE OF WINTER SQUASH

F. M. R. Isenberg and J. R. Hicks

Squash is native to the Western Hemisphere and has been classified as one of the oldest cultivated plants of the Americas. Now, some 6,000 to 8,000 years after it was first cultivated on this continent, squash is still classified as a minor vegetable in the U.S. with only about 40,000 acres of land devoted to the production of all types. Although there is no acreage breakdown for different types of squash, approximately 25 percent is in the Northeast which leans toward the winter types.

As with most crops, squash storage actually starts at harvest. At this point one must remember that the squash fruit is a living entity, and the primary goal of storage is to control and prolong that life. Squash does deteriorate during storage and although the rate of deterioration may be slowed under the proper conditions, it cannot be stopped. In practical terms this means that the better the condition of the squash going into storage, the better chance there is of having good quality coming out. Only mature squash fruit free from mechanical damage and disease should be stored. Thus, many of the problems with storing squash start in the field. Many growers harvest squash late in the fall, by which time the fruits have often been subjected to temperatures below 50° F on one or more occasions, or actually have become damaged by frost.

Injury. Freezing injury occurs when ice forms in the tissues and the damage is apparent shortly after freezing has occurred. Even slight freezing injury is detrimental to storage life since some tissue is killed and decay organisms have a point of entry into the fruit. Chilling injury is an entirely different phenomenon which occurs at temperatures above freezing. The degree of damage is time/temperature dependent. In other words, the number of hours required to induce injury at 35° F would be considerably less than the number required at 45° F. Field chilling is not usually recognized because the damage is not apparent until much later (which may be after it has been placed in storage). The second problem with field chilling is that it is cumulative. If the fruit is exposed to chilling temperatures later (storage, transit, etc.) those hours will add on to the chilling received in the field.

Harvesting. Proper harvesting operations have as much effect on subsequent storage as any cultural practices. One method is to take a rubber covered pipe and knock the fruit off the vine leaving a clean fresh scar. If this method is used,

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the squash should not be handled further for at least an hour or until this scar stops leaking fluid and starts to dry. This fluid is very sticky and runs over other fruits if loading is done immediately. It is almost impossible to scrub it off in a vegetable washer after it has dried. Another method of harvesting is to actually cut the vines with pruning shears. In this case there is practically no leakage and the vine dries into a hard button which seals the end. The method which gives the best results depends on the condition of the vine and the amount of time a grower has to harvest. Obviously it is quicker to knock the fruit off than to cut the vine, and this method is easier if the vine has dried down and is hard and brittle. On the other hand, if the vine has not dried sufficiently to break easily and cleanly there will be less damage to the fruit by cutting.

Wet weather during the harvest season also creates storage problems. If possible the squash should be dry when harvested. If this is impossible, provisions should be made to dry the squash immediately after harvest. Usually this can be accomplished by moving air over the fruit, particularly if there is some method of heating the air a few degrees above ambient temperatures. When drying the fruit it is desirable to spread the containers so all fruits can be dried quickly. After drying they can be stacked for storage. Any time containers are to be stacked care must be taken not to overfill. This damages not only the fruit in direct contact with the box above, but also creates pressure bruises on fruits below.

Storage. The length of time squash can be stored is usually determined by development of decay and/or moisture loss. A mature, unbroken rind (including freedom from field rot) offers some protection against both of these developments. If the rind is broken or damaged (including weakening due to chilling injury) it no longer functions as a barrier to water moving out of the fruit and is especially ineffective in keeping decay organisms out. Low temperature is usually an effective means of retarding the development of decay. However, since squash are subject to chilling injury, the full potential of this cannot be realized.

Most decay organisms need moisture in order to grow which can be free moisture from cuts and bruises. Erwinia bacterial rots frequently start in cuts and bruises. Rhizopus soft rot is another storage disease. The early symptom is a softening and water soaked lesions which spreads internally. It has a sour odor and there is a distinct border line between damaged and healthy tissue.

Butternut is especially sensitive to chilling injury, while Hubbards are somewhat more resistant. The usual symptom of chilling injury is a pitting of epidermis or shell. The pits are sunken areas, where the cells are dead, and no longer constitute a barrier from attacks of fungi or bacteria. Very often these pits are the first points where one can detect Alternaria rots. Once through the shell, this disease can spread rapidly throughout the fruit. On the surface Alternaria spreads as a greenish-black fungus often covering the whole fruit. Control is achieved by preventing chilling injury, particularly in storage.

Butternut has one problem that we do not have in other winter squashes known as hollow neck. At 50 to 55° F and 50 percent relative humidity, Butternut will keep two to three months. However, if it loses as much as 15 percent weight, hollow neck develops which is a breakdown of the internal neck tissue leaving stringy fibers. This leaves it worthless for marketing, and is not easily detected from outside. The fact that Butternut varieties are most sensitive to chilling and to moisture loss tends to compound the storage problems. The higher the temperature at a given relative humidity, the greater the drying power of the air. At a relative humidity of 65 percent squash will lose more moisture if stored at 60° F than at 50° F.

It is not our intention to make specific recommendations for storage of all types of squash. Types differ in terms of storage requirement. In addition, varieties within a type may differ. The length of time a grower wishes to hold squash, as well as the condition of the squash going in, will both influence how the storage conditions must be set. The following are intended to be used as guidelines and not as exact recommendations.

Temperature--minimum of 50° F. Below this you could run into chilling injury, particularly with Butternut. If you are storing for short periods of time, the temperature can be well above 50° F to increase color and sugar content, especially on immature fruit.

Relative humidity--minimum of 50 percent. If you have excessive weight loss or have a problem with hollow neck in Butternut, chances are the humidity is too low or the storage period is excessive. If you have excellent quality squash harvested under good conditions, you may want to go as high as 75 percent relative humidity to get maximum storage life. If you suspect the crop is going to have decay problems in storage, it would probably be better to maintain the relative humidity at 50 percent and not try to store the fruit as long.

Air movement. In order to maintain uniform temperature and humidity throughout the storage, it is essential to have adequate air movement. Dead air spaces create problems in any type of storage.

Anticipate problems. The best squash harvested under the best conditions will have the longest storage life. Any squash subjected to low temperatures in the field (or storage), or harvested wet or immature should be moved first. In addition, a grower can often detect trouble spots developing in storage, regardless of whether the problem was within the condition of the squash when stored or a problem with the storage itself. Such squash should be moved as soon as possible.

DIRECT MARKETING FRUITS AND VEGETABLES - A FRESH APPROACH

J. W. Courter, Roberta Archer, C. M. Sabota, and R. E. Westgren

Consumers like to buy fruits and vegetables directly from farmers because of the freshness, vine-ripe quality, and price advantage. Some consumers may find community farmers' markets most convenient; others may prefer roadside stands; and still others may like to harvest their own produce at a "pick-your-own" farm (also called PYO or U-pick).

Sales from the producer directly to the consumer now account for an estimated 25 to 30 percent of all horticultural food crops grown in Illinois for the fresh market. Direct marketing is an important method for many major producers and is also a method of supplementing income for small operators and part-time farmers. Without direct marketing, the acreage of small fruits in Illinois would probably be greatly reduced.

In 1977 a two-year study to "improve the efficiency of farmer-to-consumer marketing in Illinois" was begun by the Illinois Cooperative Extension Service and the Illinois Department of Agriculture in cooperation. The study has a dual approach: (1) to bring more farmers to consumers through community farmers' markets and (2) to bring more consumers to "pick-your-own farms.

The first phase of the study has been an assessment of the current situation. This preliminary step will enable us to establish specific projects and measure future development.

Location and number of markets. Direct markets are located throughout Illinois, according to surveys made in 1978 with the assistance of county Extension advisers. Although heavily populated areas tend to have the greatest concentrations of community farmers' markets and PYO farms, both types of market are successful in rural counties when the number and size of the markets are not too great for the population.

In 1978, 48 communities had farmers' markets--more than twice as many as in 1977 and six times as many as in 1973. Downtown Business Associations or Chambers of Commerce sponsored 69 percent of the markets. Of the producers selling at community markets, 85 percent farmed within 27 miles of the market, 87 percent sold only their own produce, and most sold at two different markets. The majority derived less than 10 percent of their total income from these sales.

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The number of PYO producers has risen substantially in recent years. For example, about 40 percent more farmers grew strawberries for pick-your-own in 1978 than in 1968. Many producers who formerly sold only in wholesale markets have adjusted their acreages to meet local demands.

Because of topography, availability of irrigation water, and location of soils best suited for horticultural crops, a number of commercial enterprises are located in areas that are not highly populated. Thus, some producers feel they cannot take advantage of direct marketing. Others, however, have not fully realized their potential. The distribution of PYO farms suggests that opportunities for direct marketing exist near many Illinois cities and towns.

Crops in direct markets. A wide variety of vegetables and fruits is sold directly to consumers by Illinois farmers. The leading crops, listed in Table 1, returned an estimated 8 to 10 million dollars to direct market producers in 1978. Strawberries, apples, tomatoes, sweet corn, and peaches each brought in 1 million dollars or more.

Illinois strawberries, blueberries, blackberries, and raspberries are marketed almost entirely through direct-to-consumer sales, mostly U-pick. Virtually all the apples produced in the northern half of the state are also sold in direct markets, with U-pick accounting for about half of the sales. Most new plantings of apples in the state are planned for direct marketing.

Consumer benefits. We estimate that 750,000 to 1 million consumers patronize direct markets in Illinois each year. Some customers may return to a conveniently located market once a week or oftener. By buying directly from the farmer, consumers typically save 19 cents on every dollar spent.

When customers at 10 community-farm markets were surveyed in 1978, most of them gave fresh, vine-ripe quality as the top reason for patronizing these markets. The importance of quality was confirmed by U-pick customers at the Dixon Springs Agricultural Center. These customers also gave local availability of produce and price savings as important reasons for patronizing a pick-your-own market. They attached least importance to the recreational aspects, and suprisingly, the cost of gasoline. The rural background of most of the patrons may account for the relative unimportance of these factors in this particular study.

The advantages of patronizing pick-your-own farms or farmers' markets lose their appeal for most people when they live farther than about 20 miles from the farm or market. This is evidenced by the replies that customers at Dixon Springs gave to the question: "Would you be willing to drive twice as far as you do now to pick your own produce?" Of those who lived within 10 miles, 85 percent said yes. Of those living 11 to 20 miles away, only 38 percent were willing to drive twice as far. This percentage dropped to 13 for customers who lived more than 20 miles away.

U-pick strawberry farms. Questionnaires asking about distance traveled and picking habits were distributed to more than 6,000 customers at 20 U-pick strawberry farms in 1978. About 30 percent of the questionnaires were returned. According to the replies, the average customers traveled 20 miles to the farm, picked 23.3 pounds of berries, and paid $8.59.

Trade areas were mapped around the farms to show the location of the customers replying to the questionnaire. Demographic information (income, age, family size) will be used to profile U-pick customers. A similar study of non-customers will be made in 1979 and 1980 under a contract with the Economics, Statistics, and Cooperatives Services, U. S. Department of Agriculture.

Information from these studies will be analyzed to develop planning aids for U-pick operators in making the most of their existing markets, enlarging their trade areas, and increasing production. Increased knowledge of U-pick customer characteristics and market potential will also aid in the establishment of new direct marketing operations.

Other activities. As part of our project, we have helped communities to evaluate the feasibility for local markets, organize downtown markets, and get in touch with producers. Practically all non-food retail merchants have favored the markets.

Consumer buying habits, obtained at 10 community markets in 1978, are being summarized. The information will help managers and producers to plan production ane markets.

Several directories--*Community Farm Markets, You Pick Strawberries*, and *U-Pick Fruits and Vegetables*--were published by the Illinois Department of Agriculture in 1978. News releases, radio, and television programs featured information about the Illinois direct market program and the directories. Similar activities are planned for 1979.

Proceedings published by the Department of Horticulture present guidelines for direct marketing and cultural recommendations. The *Roadside Market Conference Proceedings* and the *Community-Farm Market Conference Proceedings* were made possible by the direct market programs. Other proceedings available are from the *Illinois Strawberry School, Illinois Small Fruit School*, and *Illinois Vegetable Grower's School.*

TABLE 1. HORTICULTURAL CROPS SOLD IN DIRECT MARKETS IN ILLINOIS IN ORDER OF RELATIVE IMPORTANCE

Crop	Annual production for fresh sales	Estimate of amount direct marketed[1]
	(1,000 lb)	(%)
Strawberries	7,000 - 10,000	95
Apples	90,000 - 100,000	15 - 20
Tomatoes[2]	18,000	20 - 30
Sweet corn[2]	5,000,000 dozen	20 - 25
Peaches	20,000	25 - 35
Melons	30,000	40 - 50
Pumpkins[2]	15,000	40 - 50
Beans[2]	5,000	20 - 25
Squash	4,000	25 - 35
Peppers	6,000	5 - 10
Blueberries	250 - 300	90 - 95
Raspberries, blackberries	100 - 150	90 - 95
Cucumbers, pickles	8,000	5 - 10
Greens	3,000	25 - 30
Plums, pears, cherries	100 - 150	70 - 75
Cabbage	17,000	1 - 2
Grapes	400 - 600	10 - 20

[1]A percentage of annual fresh market production that is sold through roadside or on-farm markets, community-farm markets, and pick-your-own.
[2]A significant acreage of these crops is also grown for processing.

PROMOTING ILLINOIS' FRESH VEGETABLES

Randy Klein

In 1978 the Illinois Vegetable Growers Association took steps to organize an effective promotion program on a statewide basis. The program benefits all members of our association regardless of how they market their products.

..August was declared Fresh Vegetable Month in Illinois by Governor Thompson.

..We attended a food fair expo sponsored by the Ill. Dept. of Agriculture.

..Major chains were asked to participate in the program.

..We met with merchandisers to share ideas on effective promotion programs.

..A display of Illinois-grown vegetables was set up at South Water Market.

Illinois Vegetable Growers Assn.

Serving the State with the Finest Produce

STATE OF ILLINOIS

Proclamation

Illinois is a world leader in agricultural production. It is blessed with fertile soil and a climate which makes its importance in food production something for which all its citizens can be proud

A valuable segment of Illinois' agricultural economy is its vegetable production. Vegetables are an important part of a nutritional daily diet

THEREFORE I, James R. Thompson, Governor of the State of Illinois proclaim August 1978 to be FRESH VEGETABLE MONTH in Illinois. I urge all our citizens to take advantage of the nutritional value and fine flavor of the fresh vegetables produced in our great state

SECRETARY OF STATE

GOVERNOR

<u>Where do we stand?</u> We have learned a lot about promotion during the past year. We found consumers interested in our business but we must get our message to them in a manner that is concise and yet easy to understand.

The Governor's proclamation can be a springboard to remind people of the season for home-grown vegetables. People in the news media thought the proclamation was fine but it should be combined with a human interest story to be newsworthy.

People in the news media, in Extension, in the Department of Agriculture and just about everywhere will help us. They all said, "You lay the groundwork and we'll help in any way we can."

<u>Where do we go from here?</u> The job would be easier if we had thousands of dollars to spend in a promotion program. But we don't and this is where membership support is needed. We need your participation. We want to hear from all vegetable growers and members on innovative ideas that will promote your business. We need to do most of our planning during the winter so that our program is ready when th season starts.

We are looking forward to the 1979 season and the promotion of Illinois' vegetables. Let's generate a desire in consumers' minds for nutritious, delicious, fresh, home-grown vegetables. We can offer the consumer a superior quality produc

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1978 VEGETABLE RESEARCH AT THE ILLINOIS RIVER VALLEY SAND FIELD

L. R. Nelms and H. J. Hopen

Sandy soils occupy 1,238,000 acres or 3.9 percent of Illinois (Figure 1). Their coarse texture and rapid permeability present pluses and minuses to vegetable growers. Shortly after heavy rainfall timely plantings and harvests are possible. Productivity, on the other hand, is generally limited by low nutrient and water holding capacities; thus, rainfall and fertilizer applications are needed more frequently than on heavier soils for optimum yields.

Fortunately, ground water resources for supplemental irrigation are abundant under many of the sandy areas in Illinois. Yields are boosted by irrigation and acreages of irrigated land are steadily increasing. Using this water wisely to conserve energy and fertilizer, as well as maximize returns on capital investments for irrigation equipment, is a challenge to growers, industry, and researchers. Management for maximum productivity includes the selection of high yielding, disease resistant or tolerant cultivars. Other research problems on sandy soils include agricultural chemicals which may leach away from their intended sites of activity or uptake, unique weeds, and insects that inhabit sandy soils. The solution to such cultural problems as weed control may be complicated by management practices to prevent soil erosion and damage to young seedlings by blowing sands.

The Department of Horticulture established the Illinois River Valley Sand Field in the late 1960's. This 40 acre site is four miles west of Kilbourne and six miles east of the Illinois River in Mason County. Principle vegetable crops in the county are snap beans, pumpkins, melons, popcorn sweet corn, potatoes and carrots. The Plainfield soil is among the most droughty soils in Illinois. Organic matter is less than 1 percent. Particle size distribution of the upper 9 inches of soil is 0.8 percent coarse sand, 70.5 percent medium sand 27.3 percent fine sand, and 0.6 percent very fine sand and silt (L. R. Nelms, unpublished data). The subsoil is also sandy and very permeable. The total available moisture is only 1.5 inches in the upper two feet; in comparison, Muscatine and Drummer soils (silty and silty-clay loams) hold about 5.3 inches of avilable water in the upper two feet of soil.

Figure 1.
Sandy soil areas of Illinois.

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The Department of Horticulture, Agronomy, and Agricultural Engineering work in cooperation with the USDA on irrigation studies of vegetable and grain crops. The following is a report of 1978 vegetable studies.

Irrigation. Different rates and frequencies of irrigation for snap beans and popcorn were: (A) irrigation of one inch when one inch of water evaporated from a standard weather bureau evaporation pan; (B) irrigation of one-half inch when one inch evaporated from the pan; and (C) irrigation twice a week at the rate of 0.75 inches minus natural rainfall (for a total of 1.5 inches per week).

TABLE 1. EFFECT OF IRRIGATION TREATMENTS ON YIELDS OF POPCORN[1] AND SNAP BEANS, 1978[2]

Irrigation treatment	Popcorn	Snap beans
	(lb/acre)	*(lb/acre)*
(A) 100% of evaporation	2283 a[3]	2341 b[3]
(B) 50% of evaporation	1950 a	2149 b
(C) 1.50 inches/week	2741 a	4124 a

[1]Robust 41-10 (Crookham Seed Co). Planted April 26, harvested September 11, 30 inch rows.
[2]Bush Blue Lake 274 (Harris Seed Co). Planted May 19, harvested July 12, 30 inch rows.
[3]Data are the means of three replications per treatment. Means followed by the same letter are not significantly different at the 1% level.

Application of 1.50 inches per week came nearest to meeting the water requirements for optimum yields. These requirements have been reported to be about 0.25 inches per day for popcorn and 0.20 inches per day for snap beans (1). Irrigations scheduled by the evaporation pan (A+B) occurred every 5-6 days and were too infrequent to provide optimum water requirements on sand (Table 1).

Weed control studies. *Asparagus* - Karmex, Princep, and Sencor controlled weeds with no significant differences in yield. *Pumpkin* - Several herbicides, and combinations of herbicides, compared favorably with Amiben for weed control in Dickinson Field pumpkin. *Sweet corn* - Lasso or Dual combined with atrazine have not provided satisfactory weed control in corn at the sand field in recent years. In 1978 Sutan plus Aatrex provided good weed control. Dual, Bicep, and Lasso leached through the soil profile and were ineffective.

Carrot earliness. The growth of carrots was studied on the Sand Field and on a nearby commercial farm (the cooperation of Leo and Dean Pfeiffer is gratefully acknowledged). Plots were harvested every two weeks from June through October (Table 2). Yields reached 10 tons per acre by early August and 15 tons per acre by mid-August. Similar results were obtained with Danvers 126 in 1970 when yields of 15.1 tons per acre were havested on August 16 (J. S. Vandemark, unpublished data). Acreage of carrots in Mason County is expected to increase slightly in 1979.

TABLE 2. CARROT YIELDS FROM THE SAND FIELD AND A COMMERCIAL PRODUCTION FIELD IN 1978

	Time of harvest[1]							
Location	Jun 30	Jul 14	Jul 28	Aug 14	Aug 30	Sep 15	Sep 30	Oct 16
				(tons/acre)				
Sand field[2]	1.9	5.1	10.1	15.7	17.3	21.2	25.7	31.9
Production field[3]	2.8	6.1	9.8	15.0	20.5	26.6	-	-

[1]Data are the means of four 10-foot samples on each date.
[2]Danvers 126 (Harris Seed Co), planted April 14, 18 inch rows.
[3]Danvers 126 planted April 25, 12 inch rows. Commercial harvest began in mid-August.

Other horticultural research. The sand field was one of four locations for evaluation of sweet corn cultivars for horticultural characteristics and reactions to maize dwarf mosaic virus (MDMV) and wheat streak mosaic virus (WSMV). Another subject of research was a study of the effect of seed size and nitrogen fertility on pumpkin yields. These studies are reported elsewhere in this Proceedings.

Detailed accounts of research reported briefly here are contained in the Illinois River Valley Sand Field 1978 Annual Progress Report (2). This publication is available upon request. Also included in the Report are results of research on grain crops conducted by the Departments of Agronomy and Plant Pathology.

Visitors are welcome to see work in progress at the Sand Field. The 1979 Field Day is scheduled for August 30.

References

1. Irrigation guide for Illinois. 1965. Univ. Ill. Coop. Ext. Serv. AEng-866. 33 pp.

2. Nelms, L. R. 1979. 1978 Progress Report, Illinois River Valley Sand Field. Univ. Ill. Dept. Hort. Series 13.

CHARACTERIZATION OF A NEW SWEET CORN MUTANT

J. E. Ferguson, D. B. Dickinson, and A. M. Rhodes

Sweetness, tenderness, good texture (high water-soluble polysaccharides-WSP), and low starch content are four "earmarks" of a high quality vegetable corn. The two mutants most frequently used commercially are sugary (su) and shrunken-2 (sh2). The sh2 mutant is high in sugar content but low in WSP, resulting in a watery texture unsuitable to canning. The su mutant possesses appreciable amounts of WSP but lacks the high sugar levels of sh2 that many consumers desire in fresh market sweet corn. Recently an inbred line of sweet corn, IL677a, was discovered that has a sugar content comparable to that of sh2 and a WSP content equal to the su genotype. IL677a was selected from a three-way cross of (Bolivia 1035 x IL44b) X IL442a at the Illinois Agricultural Experiment Station. The kernels of IL677a also appear to be much slower to dry in the field and have a distinctively lighter colored kernel. In 1976, a study was undertaken to elucidate the character of the high sugar trait of IL677a, and to investigate possible associated traits that could facilitate breeding for the high sugar content of IL677a.

The composition of the sugar constituents in IL677a is unique for sweet corn. The three principal sugars in sweet corn are sucrose, glucose, and fructose, which decrease (in all genotypes studied) from the edible stage (20 days post-pollination) until the dry mature stage. At the edible stage, however, maltose, (a sugar rarel found in plants),was found to increase in the IL677a-type kernels. At the dry mature stage 2-3 percent of the total dry weight of the IL677a kernel was maltose. Samples of fourteen other mutant genes associated with carbohydrate synthesis in sweet corn showed only traces of maltose at all stages of development.

IL677a kernels hold their sweetness longer than other mutant genotypes and this may be related to enhanced maltose accumulation. At the dry mature stage IL677a kernels contained 100 percent more total sugars than any other carbohydrate mutant genotype studied.

Slow drying and a light yellow kernel color are associated with the high sugar content of IL677a. At 44 days post-pollination on an ear segregating for the IL677a-type kernel and normal su kernels, the lighter colored IL677a-type kernels were 6-10 percent higher in moisture and 42-89 percent higher in total sugar content than the darker su kernels. One of the differentiating factors that causes IL677a to dry more slowly than other genotypes may be its unusual maltose accumulation, which is greatest just prior to the time of kernel shriveling. Both the lighter kernel color and the slow-drying nature of IL677a type kernels considerably facilitate selection of the high sugar IL677a kernels in segregating populations. In addition, the longer retention of moisture and sugar content allow an extended period of harvest for IL677a without sacrifice of quality.

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To genetically characterize the high sugar trait of IL677a, three questions were considered: (1) is the gene an allele or a modifier of the su locus; (2) is the gene recessive or dominant to the su locus; and (3) is the gene linked to the su locus. All IL677a X su crosses produced only sweet kernels, indicating that the gene was recessive. To determine if the gene was an allele or a modifier of the su locus, segregating F_2 populations of IL677a X dent crosses were produced. The sweet F_2 kernels were analyzed for sugar content by gas-liquid chromatography after grouping of the kernels according to kernel color. On all ears the sweet kernels segregated for dark colored kernels with low sugar and light colored kernels with high sugar. No evidence was found to indicate linkage between the new mutant gene and the su locus. Thus, the gene responsible for the high sugar, slow-drying traits and lighter color of the IL677a kernels is an independent recessive modifier of the su locus. The newly characterized gene has been tentatively named sugary enhancer, se.

In conclusion, se, the gene responsible for the high sugar content of the inbred IL677a, is an independent recessive modifier of the su locus. The association established between the high sugar content of IL677a, and the lighter colored, slower drying kernel should greatly facilitate breeding for the se genotype in the future without time-consuming laboratory analysis. The unusually high maltose accumulation of the genotype may be related to its extended period of sweetness and moisture retention compared to other sweet corn genotypes.

Reference

1. Rhodes, A. M. 1978. Sweet corn varieties--today and tomorrow. Univ. Ill. Dept. Hort. Series 5:10-12.

CUCURBITACIN: A BITTER SUBSTANCE OF CUCURBITS THAT INCITES BEETLE FEEDING

R. L. Metcalf, A. M. Rhodes, and J. E. Ferguson

We previously reported that three species of corn root worms (southern, western, and northern) and an allied spp., the striped cucumber beetle, feed on cucurbit plants to obtain a bitter substance called cucurbitacin (1). Beetles that have ingested cucurbitacin are avoided by birds and other predators. Cucurbitacin is toxic to animals and has been known to poison livestock. The beetles listed above, collectively known as Diabroticites, are apparently able to metabolize and degrade cucurbitacin to a non-toxic form; thus, a chemical that was probably a plant defense against insects has become an attractant for the Diabroticites.

Cucurbitacin is found in the roots, cotyledons, leaves, and flowers of Cucurbita spp. Wild species and probably their plant ancestors, have bitter fruits, but not bitter seeds. Early man, who used the seeds for food, domesticated wild cucurbits from plants that had non-bitter fruits. This domestication, followed by continuous selection, has resulted in five cultivated species, containing well over 100 cultivars of pumpkins, squash and gourds.

The domesticated species, however, have cucurbitacin in plant parts other than the fruit, and the beetles, which coevolved with the wild cucurbits, feed on the cultivated cucurbits. The Diabroticites are especially destructive when feeding on the cotyledons and growing points of newly emerged plants.

We are currently studying various Cucurbita spp. to determine if cucurbitacin content of the cotyledons and other plant parts can explain beetle preference. If our results are positive, we will initiate breeding studies to lower cucurbitacin content as a means of reducing beetle attraction.

We, also, are exploring possible methods to control beetles through application of cucurbitacin. We have found that the beetles show high preference for the juice from bitter Cucurbita fruits, and when the juice contains an insecticide or sesame seed oil, beetles attracted to the preparation are readily killed. Since earlier studies have shown that the adult western corn root worm prefers wild cucurbits over corn, a cucurbitacin-insecticide formulation may be practical for beetle control in cornand reduce the heavy use of soil insecticides.

We have initiated a study entitled: "Coevolutionary behavior of corn root worms and cucumber beetles attacking corn and cucurbits." Experiments will be designed (a) to determine how the western corn root worm, which originally fed only on a wild Cucurbita spp., changed its food preferences and now attacks corn; and (b) to predict from these past changes, whether the insect may adapt and become more destructive to corn or other crops.

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1978 STUDIES ON THE EFFECT OF MDMV AND WSMV ON SWEET CORN

*Mark A. Mikel, Cleora J. D'Arcy, A. M. Rhodes, B. J. Jacobsen
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Sweet corn inoculated with maize dwarf mosaic virus, strain B (MDMV-B) early in the growing season was significantly lower in total yield. Wheat streak mosaic virus (WSMV) inoculation, or late season infection by MDMV-B, had no effect on yield.

Introduction. Two experiments on sweet corn viruses were conducted at Urbana, Illinois during the summer of 1978: 1) to determine the effect of MDMV-B (maize dwarf mosaic virus, Strain B, nonjohnsongrass) on the yield of a susceptible variety (Gold Cup) when plants were inoculated at different stages of growth, and 2) to compare the effects of MDMV-B and WSMV (wheat streak mosaic virus) separately and in combination, on cultivars Gold Cup (susceptible to both viruses) and Seneca Scout (thought to have some tolerance to both viruses).

Materials and methods. The time of inoculation experiment was planted May 26. Spacings were 38 inches between rows and 13 inches within rows, with approximately 13 plants per row. Plants were hand inoculated on the youngest leaves of the whorl with infectious plant sap diluted 1:4 (W/V) in 10 mM phosphate buffer, pH 7.0 with 15g carborundum/liter added as an abrasive. Two adjacent rows were inoculated on June 21, July 2, July 14, and July 24. Several surveys were made during the summer to tag plants infected by natural spread prior to inoculation, and inoculation misses, so that these plants would not be used in final yield ratings.

The WSMV and MDMV combination study was planted May 29 with 38 inch spacing between rows and 13 inches between plants within a row. The design was split plot with cultivars as main plots and treatments as sub-plots. Each sub-plot was 3 rows and data were recorded from 5 plants chosen at random from the middle row. Plants were inoculted at the 4 leaf stage (June 21) with an air brush at 80 p.s.i. Inoculum was infectious plant sap diluted 1/5 (W/V) with 10 mM phosphate buffer, pH 7.0, with 15g carborundum/liter. The treatment sub-plots were control (noninoculated), MDMV alone, WSMV alone, and both viruses (1:1 MDMV to WSMV).

Three weeks after inoculation plants were serologically assayed (microprecipitin test). Later in the season (August 11) each row of the plot was serologically assayed for MDMV and WSMV.

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Results. Total yields (ear weight) of MDMV-B inoculated Gold Cup were reduced by 43.0, 26.4, 25.6 and 15.2 percent when plants were inoculated 25 (2 leaf stage), 35, 47 and 57 days after planting. Plants inoculated in early stages of growth were shorter and had poor ear butt fill, small ear diameter, and light weight ears (Table 1). Ear marketability was impaired by the early plant infections.

TABLE 1. EFFECT OF TIME OF INOCULATION OF MDMV ON CULTIVAR GOLD CUP[1]

		First ear[2]				Second ear[2]		All ears	
Date inoculated[3]	Plant height	Butt fill[4]	Length	Dia.	Weight	Weight[5]	No.	Weight	Rating[6]
	(cm)	(%)	(mm)	(mm)	(ℓb)	(ℓb)		(ℓb)	
June 21	660	70	185	43	4.19	0.38	1	4.57 a[7]	C
July 2	750	80	190	43	4.38	1.56	5	5.94 b	B
July 14	800	100	190	42	4.44	1.56	4	6.00 bc	B
July 24	840	100	190	44	4.50	2.50	6	7.00 c	A
Control	820	100	185	45	4.81	3.25	7	8.06 d	A

[1]Planted May 26. Spacing 38" between and 13" within rows; each plot two rows, 13 plants per row.
[2]Ears harvested from 10 plants.
[3]Mechanically inoculated with 1/4 (W/V) 10 mM Na_2HPO_4 pH 7.0 on emerging leaves of whorl.
[4]Percent of ears with no butt blanking.
[5]Husked wheat, 10 ears for all treatments.
[6]Ear marketability and appearance: A = excellent B = good, C = fair.
[7]Numbers followed by different letters significantly different at the 5% level, paired t test.

The WSMV and MDMV plot results (Table 2) indicate that MDMV-B had significant effects on sweet corn growth, but there was little effect due to WSMV. The first serological assay checked the efficacy of the inoculation technique. The inoculations had been successful; double-inoculated plants gave positive reactions to both viruses. In the August 11 assay WSMV was only occasionally detected, and in all cases but one was found in rows which had been WSMV-inoculated. Thus, WSMV had not spread in the test plots. In contrast, MDMV was found to have been spread throughout the plot by aphid vectors. There was no difference between the amount of MDMV found in those rows which had been mechanically inoculated with the virus on June 21 and in those which had not. However, only those plants which were infected early in the season (5 leaf stage) had significant decreases in plant height, ear weight and butt fill (Table 2).

Discussion. To significantly decrease sweet corn yield, MDMV must infect young plants. Both experiments support this conclusion. The ability of MDMV to naturally spread quickly through a field demonstrates its potential threat to the crop. In areas where MDMV is a problem, planting sweet corn early in the season before aphids are active may reduce yield loss. In this test, WSMV had no detrimental effects on sweet corn, however, the growing conditions at Urbana in 1978 were excellent. Under more stressful conditions, or under higher inoculum pressure WSMV may decrease sweet corn yield.

TABLE 2. EFFECT OF MAIZE DWARF MOSAIC (MDMV) AND WHEAT STREAK MOSAIC (WSMV) VIRUSES ON CULTIVARS SENECA SCOUT AND GOLD CUP[1]

		Ear characteristic[3]			Weight[3]				
Cultivar	Virus treatment[2]	Butt fill[4]	Length	Dia.	First ear	All ears	Number of ears[3]	Silk to harvest	Plant height
		(%)	(mm)	(mm)	(lb)	(lb)		(days)	(cm)
Seneca Scout	Control	100	187	45.7	2.71	3.56	6.7	28	187
	WSMV	100	187	45.3	2.73	3.40	6.3	29	181
	MDMV	73*[5]	187	46.0	2.34*	2.77	6.0	28	171*
	Both	87	188	45.0	2.56	3.04	6.0	28	167*
Gold Cup	Control	100	185	45.7	2.37	3.33	7.0	30	170
	WSMV	93	183	44.0	2.42	3.02	6.3	31	172
	MDMV	53*	185	43.7*	2.34	3.48	7.3	30	160*
	Both	60*	183	44.3	2.36	3.00	6.3	30	160*

[1]Planted May 29. Spacing 38" between and 13" within rows. Split-plot design with cultivars as main plots and treatment as sub-plots. Sub-plot 3 rows, data from five plants of middle row.

[2]Inoculated at four-leaf stage (June 21) with air brush at 80 p.s.i. Infected plant tissue 1/4 (W/V) in .01 M Na_2HPO_4 buffer at pH 7.0 with 15 g/l 600 mesh carborundum. Both = inoculated with a 1:1 mixture of both viruses.

[3]Mean of five plants, three replications.

[4]Percent of ears with no butt blanking.

[5]Treatment means in columns, within cultivars, significantly different from the control at 5% level l.s.d. test.

EFFECT OF SEED SIZE AND NITROGEN FERTILIZER UPON PUMPKIN VIGOR AND YIELD

Mack A. Wilson, Walter E. Splittstoesser and Joseph S. Vandemark

Introduction

In 1976, 18,000 acres of pumpkins were grown in Illinois and Americans eat more pumpkin pie than any other pie. It is possible that large pumpkin seeds may produce more vigorous plants, with an increased production per acre, reducing the cost of America's number one pie. This report shows the interaction of seed size and nitrogen level on yield of pumpkin on two different soils over two years.

Materials and Methods

Plantings of Cucurbita moschata cv. Dickinson Field were planted in May 1977 and 1978 on the Vegetable Research Farm on a Drummer silty clay loam soil (Urbana, Illinois), and at the Vegetable Sand Farm on a Plainfield sand (Kilbourne, Illinois). The experimental design was a 3 x 3 factorial in a randomized complete block of 3 seed sizes x 3 nitrogen levels. The seeds were grouped into small (0.11-0.13g), medium (0.15-0.17g), and large (0.19-0.21) sizes. Split applications of nitrogen rates for the 1977 and 1978 growing season at the Vegetable Research Farm (Urbana) were 0, 45 and 90 kg/ha and at the Vegetable Sand Farm (Kilbourne) were 0, 45 and 90 kg/ha for 1977 and 0, 90 and 180 kg/ha for the 1978 growing season.

Seeds were planted in rows 0.8m apart with 2m between rows and 1.5km long. Amiben was applied at 4.48 kg/ha immediately after planting at the Vegetable Research Farm (Urbana) and Prefar at the rate of 3.36 kg/ha preincorporated at Kilbourne. In the 1978 growing season the per cen germination was determined 3 weeks after planting as an indication of vigor with seed size. Plants were then thinned to one plant per hill. Plants were sprayed when necessary for insect control at each location. Urea coated with Nitropyrin (N-Serve) at 3.36 kg/ha of active ingredients per ha was applied at the Vegetable Sand Farm (Kilbourne).

Fruit were harvested in mid-September and the number of fruits and weight of fruit per plot was determined. Duncan's Multiple Range was used to determine significant differences between treatments.

The entire plot at Kilbourne was irrigated from June to September and received 10.39 inches of water over the growing season.

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Results and Discussion

There was no correlation between the total number of fruits and fruit weight on the sandy soil in 1977 (Table 1). In 1978, however, large seeds produced greater yields. There was no correlation between fruit yield and plant vigor as influenced by seed size at planting.

Table 1. Influence of Seed Size at Planting on Yield of Pumpkin on Two Soils

Character	Soil Type	Seed Size		
		Small	Medium	Large
1977				
Fruit No. *	Sand	11a	12a	11a
Fruit Wt. * (kg/ha)	Sand	16993a	20281a	19290a
1978				
Fruit No.	Sand	9a	9a	10a
Fruit Wt. * (kg/ha)	Sand	15937a	15551ab	20884b
Vigor (% Germination)	Sand	74a	80a	79a
1977				
Fruit No. *	Loam	13a	16b	15b
Fruit Wt. * (kg/ha)	Loam	28305a	38955b	36486b
1978				
Fruit No. *	Loam	13a	15a	14a
Fruit Wt. * (kg/ha)	Loam	37309a	38299a	37676a
Vigor (% Germination)	Loam	49a	61b	59b

Means across not accompanied by the same letter are significantly different at the 5% level of probability according to Duncan Multiple Range.

Symbol (*) represents 10 vines per plot.

On the loam soil (Table 1) in 1977, but not 1978, there was a correlation between fruit number and fruit weight. The total number of fruits from plants produced from medium and large seeds at planting were not significantly different whether grown on the sandy or loam soil. There was no difference in plant vigor on the sandy soil between plants produced from different seed sizes and no difference in vigor between plants produced from medium and large seed on the loam soil. The total fruit yield on the loam soil was significantly greater than on the sandy soil. The highest yield on the sandy soil never approached the yield produced on the loam soil. The loam soil contained 5% organic matter and substantial amounts of nitrogen were released during the growing season, and the soil has a high water holding capacity with good drainage. These factors influenced yield. When the limitations on yield were removed, the plants produced from small seed produced less.

When nitrogen was added to the sandy soil, an increase in fruit weight occurred. However, on the loam soil, which contained a high amount of residual nitrogen, no increase in yield occurred (Table 2).

Table 2. Influence of Seed Size at Planting and Nitrogen Fertilizer on Yield of Pumpkin on Two Soils

Character	Soil Type	Kg/Ha Nitrogen			
		0	45	90	180
1977					
Fruit No. *	Sand	9a	12b	13b	-
Fruit Wt. * (kg/ha)	Sand	13045a	19410b	24109c	-
1978					
Fruit No. *	Sand	9ab	-	10a	8
Fruit Wt. * (kg/ha)	Sand	15794a	-	21304b	17273
Vigor (% Germination)	Sand	84a		81a	68
1977					
Fruit No. *	Loam	14a	15a	15a	-
Fruit Wt. * (kg/ha)	Loam	31960a	35285a	36501a	-
1978					
Fruit No. *	Loam	14a	14a	13a	-
Fruit Wt. * (kg/ha)	Loam	36242a	40851a	36190a	-
Vigor (% Germination)	Loam	57a	58a	54a	-

Means across not accompanied by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range.

Symbol (*) represents 10 vines per plot.

On sandy soil, the addition of nitrogen resulted in increased fruit yields. However, in 1978, the seeds planted in plots which contained the highest rate of nitrogen had a significantly lower germination which resulted in lower yields. The addition of nitrogen had no effect on pumpkin yields produced on the loam soil either year.

Summary

Seed size at planting time had little influence on fruit number or fruit weight at either location. More plants emerged on the sandy soil than on the loam soil but total fruit yields were always greater from plants grown on the loam soil. The addition of nitrogen resulted in increased yields on the sandy soil but had no significant effect on yields produced on the loam soil.

EFFECTS OF CULTIVARS, PLANTING DATES AND NITROGEN ON KEEPING QUALITY OF ONION BULBS UNDER COMMON STORAGE

Mooneeshwar Ramtohul and Walter E. Splittstoesser

Introduction

The storage quality of onion bulbs is mainly determined by the degree of rotting, sprouting, root growth and softening or shriveling accompanied by the loss of outer dry scales.

Decay is usually the result of infection during the growth or curing of the bulbs, but infection may also follow unfavorable storage conditions. Infection and subsequent rotting may be largely prevented by rapid and complete drying of the neck and outer bulb scales and the maintenance of this dry condition at low temperatures. Losses from rotting have been reported to be less in the early maturing onions, than in late maturing onions. Well matured Bermuda onions stored at 0°C with low (65%) and medium (80%) humidities keep well for 2 months.

Sprouting of bulbs greatly influence the storage quality of onions. Although open and thick neck bulbs are liable to sprout soon, other factors affecting normal maturity are also detrimental. The sprouting of onion bulbs increases with temperature and reaches a maximum at 15°C. At 0°C the bulbs remain dormant, while at temperatures above 15°C sprouting decreases. At a storage temperature from 9° to 15°C onion bulbs are found to sprout more quickly than at higher or lower temperatures. Humidity has been found to have very little influence on the sprouting of onions stored at various temperatures.

The amount of root development during storage is greatly influenced by relative humidity. The loss of marketable bulbs due to rooting has been reported to increase rapidly as relative humidity is increased.

The possible effects of high rates of fertilizer applied during the growing season on the keeping quality of onion bulbs have not been clearly established. In Texas, a correlation was found one year between high fertilization, particularly high N, and poor keeping quality; but the next year the trend was not clear and potash had a variable effect on keeping quality. On a muck soil, onions grown with N applied as a side dressing, without potash, was more detrimental to the keeping quality than was growing the onions with a relatively high N application at planting time. However, with 'Yellow Sweet Spanish' onions grown in Colorado, applications of high or low levels of N, whether at planting or as a side dressing, did not affect the storage quality of the bulbs.

Materials and Methods

Seeds of each cultivar (Yellow Bermuda, Granex F_1, and Yellow Sweet Spanish) were

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sown in a glasshouse in Urbana on January 5 and the seedlings were transplanted in the field on April 15 and April 30. Seeds were also planted in the field on April 15, and one month after emergence, the seedlings were thinned to a spacing of 10 cm between plants within the row.

Prior to planting, all plots received fertilizer at the rate of 45 kg N, 45 kg P_2O_5 and 45 kg K_2O per ha. Nitrogen from ammonium sulfate at the rate of 67.2 kg N/ha was applied as a side dressing on June 1; or 33.6 kg N/ha on June 1, followed by a second application of 33.6 kg N/ha on July 1.

Field experiments were carried out on the University of Illinois Farm at Urbana. Three cultivars of onions were planted in rows 4.5 m long with 90 cm between rows. The plants from each treatment (15 in number) were harvested when 75% had their tops fallen over or had turned yellow. The plants were cured under cover and as soon as the roots and tops were completely dry, they were removed, dirty scales rubbed off and the cleaned bulbs were placed in mesh bags. These were then suspended from the ceiling of a storeroom. At 30 day intervals the bulbs were separated into sprouted, rooted, decayed and dormant bulbs. The decayed bulbs included rotten and unmarketable shriveled bulbs.

Results

There was no significant difference in the percent of dormant, sprouted and decayed bulbs between early and late applications of N. None of the bulbs rooted after 30, 60, 90, or 120 days of storage.

After 30 days of storage, the significantly lower percent of dormant bulbs for 'Yellow Sweet Spanish' (Table 1) as compared to 'Granex F_1' or 'Yellow Bermuda' was due to the significantly higher percent of decayed bulbs for this cultivar. There was no significant difference in the percent of sprouted bulbs between cultivars and between planting dates after 30 days of storage.

There was no significant difference in the percent of sprouted, decayed and dormant bulbs between 'Yellow Bermuda' and 'Granex F_1' for the storage period between 30 and 60 days (Table 1). The significantly greater percent of sprouted and decayed bulbs for 'Yellow Sweet Spanish' as compared to either 'Yellow Bermuda' or 'Granex F_1' resulted in a significantly lower percent of dormant bulbs.

The storage period between 60 and 90 days showed no significant difference in the percent of dormant, sprouted and decayed bulbs between 'Yellow Bermuda' and 'Granex F_1' (Table 1). However, the high percent of sprouted bulbs that resulted during this period drastically reduced the percentage of dormant bulbs from 79.4 and 80.6, respectively for 'Yellow Bermuda' and 'Granex F_1' to 36.1 and 44.7, respectively. These results indicate that the rest period for these cultivars was over after 60 days of storage. Bulbs from 'Yellow Sweet Spanish' showed a significantly lower percent of sprouts than either 'Yellow Bermuda' or 'Granex F_1'. No differences in decayed bulbs were found between cultivars (Table 1). Most of the decay occurred due to neck rots.

At the end of 120 days of storage there were very few sound bulbs left (Table 1). Losses from sprouts were significantly higher in 'Yellow Bermuda' and 'Granex F_1' than in 'Yellow Sweet Spanish'. High losses of poor keeping quality bulbs from 'Yellow Sweet Spanish' prior to this storage period resulted in very few good quality bulbs and as a result, a low percent of sprouted bulbs became evident for this cultivar. Losses from decayed bulbs were low for all cultivars and no significant difference was found between them (Table 1).

Table 1. Effect of cultivars upon the storage quality of onion bulbs[z]

Cultivar	Percent			
	Sound bulbs	Sprouted	Decayed	Dormant
	After 30 days of storage			
Yellow Bermuda	100	0.6 a	11.1 a	88.3 a
Granex F_1	100	2.5 a	10.0 a	87.5 a
Yellow Sweet Spanish	100	0.4 a	23.3 b	76.3 b
	Between 30 and 60 days of storage			
Yellow Bermuda	88.3 a	1.7 a	7.2 a	79.4 a
Granex F_1	87.5 a	2.8 a	4.2 a	80.5 a
Yellow Sweet Spanish	76.3 b	20.3 b	17.2 b	38.8 b
	Between 60 and 90 days of storage			
Yellow Bermuda	79.4 a	38.6 a	4.7 a	36.1 a
Granex F_1	80.6 a	32.8 a	3.1 a	44.7 a
Yellow Sweet Spanish	38.8 b	18.8 b	3.3 a	16.7 b
	Between 90 and 120 days of storage			
Yellow Bermuda	36.1 a	25.5 a	0.6 a	10.0 a
Granex F_1	44.7 a	30.5 a	2.5 a	11.7 a
Yellow Sweet Spanish	16.6 b	5.8 b	0.8 a	10.0 a

[z] Means in the column followed by the same letter are not significantly different at 5% level of probability

The direct seeded treatment for the keeping quality trial included only bulbs from 'Yellow Bermuda' and 'Granex F_1' (Table 2). The 'Yellow Sweet Spanish' was excluded because of its late and erratic maturity. Early and late transplanting of 'Yellow Sweet Spanish' resulted in a significantly high percentage of decayed bulbs.

Bulbs from the direct seeded treatment maintained a high percent of dormancy (Table 2) and this was significantly greater than either early or late transplanting treatments. The small percent of losses in decayed bulbs from the direct seeded treatment was significantly lower than that from early transplanting but not different from the late transplanting treatment. The early and late transplanting treatments showed no significant difference in the percent of dormant bulbs between 30 and 60 days of storage (Table 2). This was largely explained by the lack of significant difference in the percent of sprouted and decayed bulbs between the two treatments.

Table 2. Effect of planting date upon the keeping quality of onion bulbs[z]

Planting Date	Percent: Sound bulbs	Sprouted	Decayed	Dormant
	After 30 days of storage			
Direct seeded 15 April	100	0 a	2.9 a	97.1 a
Transplanted 15 April	100	0.6 a	14.4 b	85.0 b
Transplanted 30 April	100	2.8 a	20.3 b	76.9 b
	Between 30 and 60 days of storage			
Direct seeded 15 April	97.1 a	0 a	3.8 a	93.3 a
Transplanted 15 April	85.0 b	8.9 b	12.5 b	63.6 b
Transplanted 30 April	76.8 b	9.1 b	7.8 ab	59.9 b
	Between 60 and 90 days of storage			
Direct seeded 15 April	93.3 a	35.8 a	1.2 a	56.3 a
Transplanted 15 April	63.6 b	33.9 a	2.5 a	27.2 b
Transplanted 30 April	60.0 b	25.8 b	6.4 b	27.8 b
	Between 90 and 120 days of storage			
Direct seeded 15 April	56.2 a	38.7 a	0 a	17.5 a
Transplanted 15 April	27.2 b	18.6 b	1.1 a	7.5 b
Transplanted 30 April	27.8 b	15.8 b	2.5 a	9.5 b

[z] Means followed by the same letter in the column are not significantly different at 5% level of probability

The direct seeded treatment showed a high percent of sprouts between the 60 and 90 day storage period (Table 2). There was no significant difference in the percent of sprouted and decayed bulbs between the direct seeded and early transplanting treatments. However, early transplanting had a significantly lower percent of dormant bulbs than the direct seeded treatments (Table 2). The percentage of dormant bulbs between early and late transplanting was not found to be significant after 60 to 90 days of storage; but late transplanting had a significantly lower percent of sprouts and a higher percent of decayed bulbs than early transplanting.

The percent of sprouted bulbs in the direct seeded treatment was significantly higher than either early or late transplanting treatments after 90 to 120 days of storage. The significant difference in the percent of decayed bulbs was shown between the planting date treatments. Early losses of unmarketable bulbs from 'Yellow Sweet Spanish' contributed to a significantly lower percent of dormant bulbs for early and late transplanting treatments as compared to the direct seeded treatments. There was no significant difference in the percent of dormant bulbs between early and late transplanting treatments.

Discussion

The lack of significant difference in the keeping quality of bulbs for early and late application of nitrogen is similar to previous studies in Colorado where losse in storage from sprouts and rots were not affected by applying one half of the N at planting and the remainder as a side dressing in mid-June as compared to applying all the N at planting.

Cultivars differ in the keeping quality of bulbs and from previous studies 'Yellow Bermuda' and 'Yellow Sweet Spanish' have been classified to be of poor and fair storage quality, respectively. However, erratic maturity and severe infection by purple blotch disease for 'Yellow Sweet Spanish' resulted in heavy losses from sprouts due to thick necks and to decay. The low percentage of sprouted bulbs for 'Yellow Bermuda' and 'Granex F_1' at the end of 30 and 60 days of storage was probably due to the rest period that follows after harvesting and curing of bulbs. Temperature had little influence on the high percent of sprouting for 'Yellow Sweet Spanish' as the average temperature during storage was 21.6°C and from previous studies, it has been confirmed that temperatures above 15°C decrease sprouting. It appears that factors prior to storage, namely, improper maturity, thick necks and severe purple blotch disease were conducive to the high percent of sprouted bulbs.

The high percent of sprouted bulbs that resulted after 60 days of storage for 'Yellow Bermuda' and 'Granex F_1' indicated that the rest period for these cultivars was over after this time. This concurs with previous results for 'Yellow Bermuda' when well matured bulbs stored well for 2 months. The direct seeded treatment which consisted of bulbs from the above cultivar showed the same trend after 60 days of storage. The lack of response to rooting during each storage period studied was mainly due to low relative humidity that prevailed during the entire period of storage.

THE USE OF ETHEPHON, SADH AND CCC
TO CONTROL THE HEIGHT OF TOMATO PLANTS AT TRANSPLANTING

James M. Pisarczyk and Walter E. Splittstoesser

Abstract

(2-chloroethyl) phosphonic acid (ethephon), succinic acid-2,2-dimethylhydrazide (SADH) and (2-chloroethyl) trimethylammonium chloride (CCC) decreased the growth of transplants of tomato (Lycopersicon esculentum Mill.) when applied in the glasshouse. In descending order of effectiveness in controlling transplant height were a SADH-CCC combination, SADH, ethephon, and CCC. SADH or CCC resulted in decreased leaf area four weeks after application, while ethephon had no effect. Clipped and unclipped transplants were used as controls. Upon transplanting, the clipped plants were greatly delayed in fruit set up to 1 month and SADH-CCC and SADH treated plants were delayed 10 days in fruiting. Total season yield was not affected but clipped plants produced the largest sized fruits.

Introduction

Tomato transplants are grown for a specific planting date, but sometimes cannot be transplanted at that date due to cool weather or lack of field preparation. With such delays, the plants can become elongated, or "leggy", and are not desirable for transplanting. Transplants may be kept cool and dry in the glasshouse in an attempt to limit their growth, or clipped in the field. Growth regulators may be used to control transplant height. The growth regulators, SADH, CCC, and ethephon, were used to control transplant height, and the effect on leaf area determined. The tomatoes were then transplanted into the field to determine effects on blossoming, fruit set, and yield. CCC has not been cleared for use on tomatoes.

Materials and Methods

'Jet Star' tomatoes were grown in the glasshouse in cellpacks with a plant spacing of 10 x 10 cm for 6 wks. Plants were grown in 2:soil/1 sand (by vol) and received applications of soluble fertilizer. The growth regulators were applied to 6 week old plants as foliar sprays with a conveyor belt sprayer at 90 cc/m^2. CCC was applied at 1,000, 2,000 and 3,000 ppm; SADH at 2,500, 5,000 and 7,500 ppm and ethephon at 100, 250 and 500 ppm active ingredient. Plant height was recorded at application and 14 days later. The number of new leaves initiated, the leaf area of the leaves present when sprayed, leaf area of the new leaves initiated, and total leaf area was recorded 4 weeks after application. Leaf area was measured with an automatic leaf area meter (Lambda Instruments Corporation, Lincoln, Nebraska).

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Control plants were grown similar to those which were sprayed with growth regulators. When these plants were 6 weeks old, some plants were clipped above the fourth leaf, and others were kept cool (unheated glasshouse 28°C max day/ 3° min night) and dry (to the point of slight wilting).

All plants were transplanted into Drummer silty clay loam soil at 10 weeks of age. Standard local practices of fertilizer placement and pest control were used in all experiments. Plants were placed 1.5 m between rows and 0.6 m within the row in a completely randomized design of 4 replicates with 9 plants being analyzed per replicate. Fruits were harvested at 2 week intervals and their number and weight recorded.

The percentage of plants with blossoms was measured until all plants had blossomed. The percentage of plants with fruit set was later measured until all plants had set fruit.

At the end of the season (4 mo after transplanting), the vegetative, above-ground part of two plants per experimental unit was harvested. The plants were frozen at -18°C for 48 hr and then dried in a forced-air corn drier 38°C for 4 days; crushed and dried to a constant weight at 100°C for 24 hr and their dry weight determined. Samples of fruit were similarly dried and the dry weight recorded.

The entire experiment was repeated twice.

Results

CCC controlled the increase in height of tomato transplants for two weeks (Table 1). CCC reduced the growth of transplants in response to increasing rates, 14 days after application. A 30% reduction in growth occurred at the high rate of CCC applied and 2 days after application, a marginal chlorosis appeared on the newly formed leaves, but these areas re-greened within one week. The total leaf area increased little in response to increasing rates of CCC. The number of leaves initiated after application was not significantly affected by treatment with CCC, and thus did not influence the reduction in leaf area.

SADH inhibited the growth of transplants in response to increasing concentrations, 14 days after application (Table 1). A 50% decrease in growth at the high rate of SADH occurred. Part of this reduced growth may be due to the decrease in the number of new leaves initiated as shown by the decrease in total leaf area (Table 1). The development of the total leaf area was inhibited as the rate of SADH applied increased.

Ethephon induced a linear reduction in the growth of transplants in response to increasing concentration, 14 days after application (Table 1). One day after application, the leaves of plants treated with 500 or 250 ppm ethephon were epinastic, while other plants did not show this response. Application of ethephon did not significantly affect the number of new leaves initiated or the total leaf area (Table 1).

Table 1. Effect of growth regulators on tomato transplant height and total leaf area before transplanting into the field.

Material	Concn (ppm)	Increase in height (cm)[z]	leaf area (cm^2)[y]
CCC	0	17.5	1932
	1000	14.3	1654
	2000	12.4	1616
	3000	11.7	1375
(Significance)[x]	--	ℓ*	ℓ*
SADH	0	11.5	1461
	2500	6.6	1322
	5000	7.1	1361
	7500	5.9	1280
(Significance)[x]	--	ℓ*g*c*	ℓ*
Ethephon	0	15.9	1540
	100	12.5	1535
	250	9.6	1538
	500	8.4	1419
(Signigicance)[x]	--	ℓ*g*	--

[z] Measured 14 days after application.

[y] Measured 4 weeks after application. Initial leaf area was not significant within treatments.

[x] Significance measured within each treatment. ℓ*, g*, c* denote linear, quadric and cubic effects, respectively, at 5% level of probability.

A combination of SADH and CCC prevented an increase in height of tomato transplants for two weeks (Table 2). All combinations used inhibited growth of transplants 1-2 weeks after application, and the chemicals were still active during the second week. The reduction in growth was approximately 70-80% with all combinations. There were no visible effects of the SADH-CCC combinations on the leaves of the transplants at any time.

The time from transplanting to blossoming was affected by the various treatments (Table 3). Six days after transplanting, the untreated, dry and cool, and CCC treatments contained plants which were 100% blossoming while SADH and ethephon significantly reduced the number of plants which were blossoming. Twelve days after transplanting only the clipped and ethephon treated plants were significantly lower in the percent of the plants with blossoms. Sixteen days after transplanting, plants in all treatments were 100% with blossoms except the clipped plants, which were not blossoming. The clipped plants were not 100% in blossom until 30 days after transplanting.

Table 2. Effects of various SADH-CCC combinations on increase in tomato transplant height one and two weeks after application.

SADH concn (ppm)	CCC concn (ppm)	cm Increase in plant height (days after application)		
		7	14	Change in height between 7 and 14 days after app.
0	0	9.85 a[z]	15.87 a	6.02 a
5000	1000	1.74 b	2.78 b	1.04 b
7500	1000	1.58 b	2.51 b	0.92 b
5000	2000	1.72 b	2.53 b	0.81 b

[z] Means in columns not followed by same letter are significantly different at 5% level of probability.

The time from transplanting to fruit set was also affected by the various treatments (Table 3). Fourteen days after transplanting, plants treated with CCC had the highest percentage of fruit set; followed by plants receiving the dry and cool treatments and then the untreated plants. Plants in the following treatments contained significantly fewer plants with fruit set: clipped, ethephon, SADH and the SADH-CCC combination. Twenty-five days after transplanting, untreated, dry and cool, ethephon, and CCC treated plants contained 80-100% of the plants with fruit set. Plants which were clipped or treated with the SADH-CCC combination or SADH alone contained significantly fewer plants with fruit set, and plants receiving these treatments still had reduced fruit set thirty-seven days after transplanting. Forty-one days after transplanting there was no significant difference between treatments in the percent of plants which had set fruit.

The yield harvested 80 days after transplanting was affected by the various treatments applied (Table 4). Clipped, ethephon, SADH-CCC combination, or SADH treated plants produced lower weights of fruit compared to the untreated plants. No treatment significantly increased fruit weights. The low rate of CCC treatments produced plants with the largest number of fruit per plant, while clipped, ethephon, SADH-CCC combination, or both rates of SADH treated plants produced significantly fewer fruit per plant. The plants that were clipped produced significantly larger fruit than fruit from any other treatment. No treatment produced plants with significantly smaller fruit than the untreated plants (data not shown). The yield harvested 95 days after transplanting was not significantly different between treatments (Table 4). There was no significant difference between treatments in the total weight of fruit produced over the entire season (Table 4) or in the number of fruit per plant compared to the untreated plants.

Table 3. Effects of various treatments on blossoming and fruit set of tomato transplants in the field.

Treatment	Days after transplanting					
	% Plants blossoming			% Plants with fruit set		
	6	12	16	14	25	37
Untreated	92 ab[z]	100 a	100 a	53 bc	100 a	100 a
Dry and cool	92 ab	100 a	100 a	61 bc	94 ab	100 a
Clipped	0 f	0 c	0 b	0 d	0 d	78 b
250 ppm ethephon	28 e	72 b	100 a	6 d	83 b	97 a
1000 ppm CCC + 5000 ppm SADH	78 bc	100 a	100 a	0 d	3 d	64 b
5000 ppm SADH	69 cd	100 a	100 a	3 d	17 c	81 b
7500 ppm SADH	50 de	97 a	100 a	0 d	14 c	75 b
1000 ppm CCC	100 a	100 a	100 a	81 ab	100 a	100 a
2000 ppm CCC	97 a	100 a	100 a	86 a	100 a	100 a

[z] Means in a column not followed by the same letter are significantly different at 5% level of probability.

At the end of the season, the dry weight of the vegetative part of the plant was not significantly different between treatments. When the dry weight of the fruit was added to the vegetative dry weight, only the high rate of CCC had induced plant to accumulate significantly less dry matter than the untreated plants and no treatm t produced plants with more dry matter than the untreated plants.

Table 4. Effect of various treatments on yields of tomato transplants in the field.

Treatment	Yield (metric tons/ha)		
	Days after transplanting		
	80	95	Total
Untreated	9 a[z]	46 ab	75 ab
Dry and cool	8 ab	46 ab	80 ab
Clipped	1 c	44 ab	80 ab
250 ppm ethephon	7 b	47 ab	73 ab
1000 ppm CCC + 5000 ppm SADH	0 c	50 a	77 ab
5000 ppm SADH	2 c	50 a	75 ab
7500 ppm SADH	1 c	50 a	76 ab
1000 ppm CCC	9 a	46 ab	81 a
2000 ppm CCC	16 a	42 b	68 b

[z] Means not followed by the same letter are significantly different at 5% level of probability.

Discussion

Ethephon, CCC, SADH, and SADH-CCC combination were capable of reducing the growth of transplants for use as a "holding" operation. The SADH-CCC combination was found to be the superior treatment with SADH and ethephon treatments somewhat less effective and CCC was the least effective. As a SADH-CCC combination was found to be the superior treatment, combinations of growth regulators may be used in a manner similar to the use of herbicide combinations.

Some leaves of ethephon treated tomato plants were epinastic and it is known that ethephon induces as asymmetric expansion of cells on the upper side of the leaf petiole. The treated leaves in the present study remained epinastic, with no recovery, but no other visible damage to the leaves occurred. No permanent damage to leaves occurred at any rate of CCC or SADH used. CCC inhibited the growth of old and new leaves, but did not affect the number of new leaves initiated. Tomatoes initiated fewer leaves after treatment with SADH, but ethephon did not affect leaf area or number.

No treatment hastened blossoming compared to the untreated plants and blossoming was delayed by several treatments. The clipped treatment delayed blossoming to the greatest degree with full blossoming occurring 2-3 weeks later than other treatments. Ethephon, a SADH-CCC combination, or SADH delayed blossoming less than a week compared to untreated plants. CCC hastens blossoming of tomatoes in the glasshouse but in field studies blossoming of CCC treated plants occurred at the same time as untreated plants.

No treatment hastened fruit set compared to the untreated plants. Clipped plants were delayed in setting any fruit, with the first fruit set 2 weeks later than untreated plants. This delay in fruit set was the result of the noted delayed blossoming. Fruit set was delayed most by clipped treatment, the SADH-CCC treatment, or SADH. These treatments delayed full fruit set for 2 weeks.

The slight delay in blossoming and fruit set induced by the SADH-CCC combination or by SADH treatments alone could be of some benefit. The plants would not be in blossom when being transplanted and the photosynthate produced would be used by the vegetative part of the plant to produce a normal size crop. The slight delay in blossoming would allow the plant to become established and resume growth before it sets fruit.

Clipped plants produced the largest yield 80 days after transplanting. This was a result of the plants being larger vegetatively at the time of fruit set and thus having a large photosynthetic area for the production of larger fruit. However, 95 days after transplanting, the yield and the number of fruit per plant was not significantly affected by any treatment. No treatment significantly differed from untreated plants in total number of fruit per plant. If a growth regulator is to be used to control the height of transplants, it cannot decrease yield later in the season, and no reduction in yield was found in these studies.

1979 VEGETABLE VARIETIES FOR COMMERCIAL MARKET GROWERS

J. S. Vandemark and J. W. Courter

Varieties of vegetables are listed below as a guideline to help market growers select new and improved varieties. The newest varieties that show promise for Illinois are suggested (trial). Try them along with some of the ones that appear promising in current catalogs and trade publications. Individual market preferences, season of maturity, methods of culture, and varietal adaptation to soil and climatic factors will influence performance and the ultimate selections.

Additional information on varieties for these and other vegetables is in "Vegetable Gardening for Illinois," Circular 1150. This book is available at cost of $2 from Office of Publications, 123 Mumford Hall, University of Illinois, Urbana, IL 61801. Make checks payable to the University of Illinois.

ASPARAGUS

California Number Series (trial)
F_1 Hybrids (trial)
Martha Washington
Mary Washington

BEANS, SNAP - (*green*)

Astro
Avalanche
Blue Crop
Bush Blue Lake
Cascade
Contender
Del Ray
Eagle (trial)
Early Gallatin
Galagreen
Green Genes
Greensleeves
Harvester
Provider
Slenderette
Slim Green
Spartan Arrow
Sprite
Tendercrop
Tenderette
Tendergreen
Tenderwhite

BEANS, SNAP - (*yellow*)

Gold Crop
Midas
Moongold
Resistant Cherokee
Resistant Kinghorn
Sungold

BEANS, LIMA

Allgreen
Fordhook 242
Thaxter
Thorogreen

BEETS

Detroit Dark Red (strains)
Explorer
Firechief
Garnet
Gladiator
Honey Red (trial)
Mono-King
Perfected Detroit
Red Ball
Red King
Royal Red
Ruby Queen

J. S. Vandemark and J. W. Courter are Extension Specialists in Vegetable Crops, University of Illinois.

page insert 90-91

d white)

Clemson Spineless
Dwarf Green Long Pod
Emerald

Staddon's Select
Tasty
Yolo Wonder

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Cascade
Contender
Del Ray
Eagle (trial)
Early Gallatin
Galagreen
Green Genes
Greensleeves
Harvester
Provider
Slenderette
Slim Green
Spartan Arrow
Sprite
Tendercrop
Tenderette
Tendergreen
Tenderwhite

BEANS, SNAP - (*yellow*)

Gold Crop
Midas
Moongold
Resistant Cherokee
Resistant Kinghorn
Sungold

BEANS, LIMA

Allgreen
Fordhook 242
Thaxter
Thorogreen

BEETS

Detroit Dark Red (strains)
Explorer
Firechief
Garnet
Gladiator
Honey Red (trial)
Mono-King
Perfected Detroit
Red Ball
Red King
Royal Red
Ruby Queen

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BROCCOLI

Gem (trial)
Green Comet
Green Duke (trial)
Premium Crop

BRUSSELS SPROUTS

Green Gem (trial)
Jade Cross Hybrid
Jade Cross Hybrid E

CABBAGE - *(early)*

Emerald Cross
Head Start
Jet Pak
Market Dawn
Market Victor
Resistant Golden Acre
Stonehead

CABBAGE - *(main crop)*

Danish Ballhead
Defender* YR, BRR[1] (trial)
Gourmet YR
Greenback YR
Green Winter (trial)
Guardian* YR, BRR (trial)
King Cole YR
Market Prize
Market Topper
Resistant Danish
Rio Verde
Round-up YR
Superette YR (trial)
Super Green YR (trial)
Titanic YR (kraut)

CABBAGE - *(special)*

Savoy
- Savoy Ace
- Savoy King

Red
- Red Acre YR
- Red Danish
- Red Head
- Ruby Ball

CARROTS

Chantenay Red Cored
Dominator
Gold King (strain or Red Chantenay)
Gold Pak
Grenadier
Hi-Pak Nantes
Pioneer
Royal Chantenay
Spartan Fancy
Tuchon
Tendersweet
Trophy
Waltham Hi-Color

CAULIFLOWER

Imperial 10-6
Self Blanche
Snow Crown
Snow King
Snowball Strains

CHARD

Burgundy (red)
Lucullus (white)

COLLARDS

Georgia
Vates

CUCUMBERS

Burpee Hybrid
Challenger
Gemini
Pacer (trial)
Poinsett
Poinsett 76 (trial)
Potluck (early, trial)
Saticoy
Marketmore 70
Marketmore 76 (trial)
Slicemaster (trial)
Sweet Slice (trial)
Victory (trial)

CUCUMBERS - *(pickles)*

Compass (trial)
Early Pic
Green Pak (trial)
Green Star (trial)
Liberty (trial)
Peppi
Pioneer
Salty
Spartan Dawn
WIS SMR 18

CUCUMBERS - *(greenhouse)*

La Reine

*should be used when Black Rot is a factor

[1]YR = yellows resistant
BRR = black rot resistant

Varieti
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ASPARAG

Califor
F_1 Hybr
Martha
Mary Wa

BEANS,

Astro
Avalanc
Blue Cr
Bush Bl
Cascade
Contend
Del Ray
Eagle (
Early G
Galagre
Green C
Greensl
Harvest
Provide
Slender
Slim Gr
Spartar
Sprite
Tendero
Tender
Tenderg
Tenderwhite

Ruby Queen

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EGGPLANT - (*large oval*)

Black Beauty
Black Jack
Black Magic Hybrid
Burpee Hybrid
Classic
Dusky (early, trial)
Jersey King (trial)

KALE

Dwarf Blue Curled Scotch
Dwarf Curled
Dwarf Siberian

LEEK

Conqueror
Electra
Tivi

LETTUCE - (*greenhouse*)

Bibb
Grand Rapids (tip burn resistant strains)

MUSKMELON

Burpee Hybrid
Early Crenshaw (trial)
Gold Star Hybrid
Harper Hybrid
Harvest Queen
Saticoy Hybrid
Star Trek (trial)
Supermarket Hybrid

MUSTARD

Green Wave
Southern Giant Curled

OKRA

Clemson Spineless
Dwarf Green Long Pod
Emerald

ONIONS - (*yellow*)

Abundance
Autumn Spice
Autumn Splendor
Bounty
Fiesta
Golden Globe
Nutmeg
Ringmaster
Topaz
Yellow Globe

ONIONS - (*red*)

Benny's Red
Ruby

ONIONS - (*transplants*)

Benny's Red (trial)
Sweet Spanish types (yellow and white)
Ruby (trial)

ONIONS - (*green bunching*)

Beltsville Bunching
Evergreen Long White
Southport
White Lisbon

PEPPERS - (*bell type*)

New Ace (trial)
Bellringer
Better Belle (trial)
California Wonder
Early Calwonder
Early Prolific (trial)
Early Set (trial)
Florida VR-2 (trial)
Keystone Resistant Giant
Lady Bell
Staddon's Select
Tasty
Yolo Wonder

PEPPERS - (*special*)

Cubanelle
Hungarian Wax
Jalapeno
Sweet Banana

POTATOES - (*early*)

Cobbler
Norchip
Norland
Superior

POTATOES - (*late*)

Kennebec
Red La Sota
Red Pontiac

PUMPKINS - (*small*)

Small Sugar
Spookie
Sugar Pie

PUMPKINS - (*intermediate*)

Funny Face
Spirit
Young's Beauty

PUMPKINS - (*large*)

Big Tom
Conn Field
Halloween
Howden Field
Jackpot

SPINACH - (*spring*)

LS Bloomsdale
Melody
Winter Bloomsdale

SPINACH - (*fall*)

Early Hybrid 7
Melody
Old Dominion
Savoy Hybrid
Winter Bloomsdale

SQUASH - (*summer*)

Yellow
- Early Prolific Straightneck
- Golden Girl
- Golden Zucchini (trial)
- Seneca Butterbar Hybrid
- Seneca Prolific

Green
- Zucchini
- Zucchini Hybrids

SQUASH - (*winter*)

Acord
- Ebony
- Royal Acorn
- Table Ace (semi-vining)
- Table King (bush)
- Table Queen

Butternut
- Hercules (large)
- Hybrid Butternut
- Regular
- Waltham

Buttercup

Delicious
- Golden
- Green

Hubbard
- Blue
- Golden
- Green
- Improved
- Warted

Kinred

NK 530

NK 580

SWEET CORN - *(early)*

Aztec
Earlibelle
Earliking
Northern Belle
Spring Gold
Sundance

SWEET CORN - *(main crop)*

Bellringer (trial)
Bonanza (trial)
Cherokee (trial)
Gold Cup
Golden Gleam (trial)
Merit (trial)
NK 199
Reliance (trial)
Seneca Chief
Seneca Scout (trial)
Style Pak
Sweet Sal (bicolor)
Sweet Sue (bicolor)

SWEET CORN - *(late)*

Biqueen (bicolor)
Country Gentlemen
Golden Queen
Silver Queen

SWEET CORN - *(high sugar)*

Candy Bar (trial)
Candyman (trial)
Early Xtra Sweet (trial)
Honeycomb (trial)
Illini Xtra Sweet (trial)
Sugar Loaf (trial)

SWEET POTATOES

Centennial
Jasper
Nugget

TOMATOES - *(early)*

Campbell 1327
Heinz 1350
Heinz 1439
Spring Giant
Springset (north)
Starfire (north)

TOMATOES - *(main crop and late)*

Better Boy
Better Girl (trial)
Big Girl (trial)
Bragger (trial)
Burpee VF
Floramerica (trial)
Jet Star
Main Pak (trial)
Pink Wrap (pink)
Red Pak
Royal Flush (trial)
Show-Me (trial)
Sunripe
Super Fantastic
Supersonic
Traveler 76 (pink)
Wonder Boy VF

TOMATOES - *(yellow, orange)*

Golden Boy
Jubilee
Sunray

TOMATOES - *(greenhouse)*

Michigan-Ohio Hybrid
Ohio WR-13
Ohio WR-25

TURNIPS

Just Right Hybrid
Purple Top White Globe

WATERMELONS - *(seeded)*

Charleston Gray
Crimson Sweet
Iopride (trial)
Jubilee
Sweet Favorite (trial)
Sweet Princess
Yellow Baby (early, yellow flesh, trial)

WATERMELON - *(seedless, require a pollinator, special germinator techniques and usually are transplanted)*

Tri X 313
Triple Sweet

NEW VEGETABLE VARIETIES

J. W. Courter

The following list includes many new vegetable varieties that may prove to be suitable for growing in Illinois. Both commercial and hobby gardeners are encouraged to try new varieties and compare them with their standard or favorite ones.

The varieties listed in this report were submitted by the seedsmen on page 103 Some of the varieties are only available in small trial quantities while others may be available in commercial quantities from sources in addition to those given. Some varieties may not be included in catalogs and growers are advised to inquire about their cost. The asterisk (*) denotes a hybrid when this information was known. The descriptive notes are necessarily brief. Few of the varieties have been tested in Illinois and inclusion does not constitute a recommendation.

What affects performance? Growers are encouraged to test new breeding developments to judge their potential for their market or use. Some factors that influence performance of a variety or hybrid including climate--temperatures, rainfall, humidity; soil--type, fertility, drainage; season--spring, summer, or fall cropping; culture--planting distances, training methods, mulch, fertilizer treatment; method of harvest--hand or machine; and intended use--fresh, storage, processing, or shipping. These factors vary for different locations in the state.

Trial tips. The following tips will aid gardeners to evaluate new varieties and hybrids.

1. Limit the number of new ones to try.
2. Compare them with your standard or favorite.
3. Select a location with uniform soil and drainage where all will receive the same spray and cultural treatments. Avoid the edge of a garden where uncontrollable factors (lawn mower, children dogs, etc.) may influence the results.
4. Plant all the varieties on the same day and in the same way, both in the greenhouse and in the field.
5. Label each row or plant carefully. Draw a map and keep it in a safe place.
6. Record observations of plant growth, yield, disease, and fruit characteristics. These records will help you to make variety decisions next year.

University trials. From time to time University horticulturists test varieties at various locations in Illinois. Study reports on pages 36-56 and consider the location to select new varieties to try for your area and market.

J. W. Courter is Extension Specialist in Vegetable Crops.

LIST OF NEW VEGETABLE VARIETIES

ariety or hybrid	Company	Brief descriptive notes
EANS (BUSH)		
Bonanza Wax	A	Bright yellow wax bean, round, compact plants.
Bush Blue Lake 47	A	Round, medium dark green.
Checkmate	A	Round, medium dark green.
Eagle	A	Round, medium green, straight, relatively long and slender. Shipping.
Exp. 75-1498	MSU	Romano type wax bean, to be named.
Greenpak	R	A round dark green bean, good taste and slow seed development. Blue Lake type.
Green Ruler	H,MSU	Romano type snap bean with good flavor.
Lakeland	NK	Large, smooth, straight, round Blue Lake type. Strong bush.
Lancer	R	Slender, long Blue Lake type.
NCX 8009	N	Oval with smooth, straight pods.
Paymaster	NK	Large, round medium dark 6" pods.
Roma	R	A flat podded bean similar to the Pole Romano, but on a bush. Distinctive taste.
Spurt	A	Round, medium green. Shipping.
Stretch	A	Round, straight, dark green.
3EET		
Asgrow Wonder	A	Tall, green, semi-globe.
Gladiator	NK	Round, smooth, small tap root, dark red.
Redpack	A	Short, green-red, full globe.
Warrier*	H	Early, vigorous, high quality.
BROCCOLI		
Emperor*	NK	Early, 7-8" head, uniform.
Futura*	A	Heads are medium large, well rounded, uniform and medium blue-green.
Gem*	A	Medium large head on semi-divided stem, uniform with blue-green buds.
CABBAGE		
Banner	A	Head round and solid; compact, short stem.
Blue Crown*	H	Early Danish, yellows resistant.
Blue Heaven	SS	Substitute for Gourmet and Prime Pak.
Cole Cash*	N	58 days, compare to Sprite, does not burst with size. Yellows resistant.
Defender*	H	Hybrid 15 type, black rot and yellows resistant.
Enterprise	A	Plants erect and short stemmed; heads are bright green, full globe.
Express	A	Plants erect and compact; medium green, full globe.
Genesee*	H	High dry matter, late kraut and slaw cabbage. Low water content, high case recovery.
Grand Slam*	NK	Round, slightly flat head, 7" diameter. Medium core, excellent wrapper leaves.

(continued)

Variety or hybrid	Company	Brief descriptive notes
CABBAGE (continued)		
Green Winter	H	Excellent winter storage cabbage. Not Y.R.
Guardian*	H	M. Victor type, black rot and yellows resistant.
Head Start	A	Plants erect and compact; uniform and full globe.
Hybrid N*	H	Late Sanibel type, exc. vigor, yellows resistant.
Market Packer*	H	Early Sanibel type, dual purpose, yellows resistant.
51017*	H	M. Topper type, black rot and yellows resistant.
CARROTS		
Bonnanza	NK	Red cored Chantenay type, similar to Tahoe.
Danvers Gold*	J	Seed expensive. Excellent color, exceeded only by Lucky's Gold. Developed by Univ. Wisc.
Danvers Pride	N	Danvers half long type with longer maturity and better interior color than Danvers 126.
Fanci-Pak*	NK	Imperator type, 56 days, 10½ to 11½ x ¼", 15-20" tops, very uniform color.
Gold King	J	Chantenay carrot with size, and excellent color. Good muck carrot developed by NK.
Gold Pak 263	A	Roots long, slender and smooth; exterior color bright orange.
Hicolor 9	A	Long-rooted, slender and tapering; deep orange.
Minicor	R	Baby carrot for the garden and fresh markets.
Red Core Chantenay 503	A	Roots relatively short, heavy and taper to a stump at the tip; uniform orange.
Tahoe*	NK	Red cored Chantenay type, smooth, uniform internal color, 7" length.
Woodland*	NK	Imperator type, 56 days, 10 to 11½ x 1¼", 15-20" tops, long, slender, uniform color.
CAULIFLOWER		
Elgon	R	Large upright heads.
MSU 812	MSU	Three weeks earlier than Self Blanche, semi-upright.
Olympus	A	Plants large; heads large, tight, smooth and white.
Snowflower	A	Plants large; heads large, deep, smooth and white.
White Top	R	High yielding, firm head.
817	MSU	Early upright leaves. Good curd quality. Limited trial packets available from Mich. State Univ.
873	MSU	
876	MSU	
879	MSU	
CELERY		
Calmario	N	Compares closely to Tall Utah 52-70R, has thicker and more petioles per stalk. Popular in Michigan.

(*continued*)

'ariety or hybrid	Company	Brief descriptive notes
:UCUMBER		
Bounty*	A	Pickle, blocky, medium green.
Bush Crop	G	Bush type for home gardens, excellent fruit.
County Fair	J	Pickler, white spine, disease resistant. Non-bitter and seedless if isolated. Excellent yield and quality. C. E. Peterson, USDA.
Dasher*	HO,PS	Slicer, early, straight, slim, dark green, resistant to many diseases.
Dublin	SS	Slicer, dark green.
Green Bowl*	KY	Slicer, sweet, burpless.
Hyslice*	C	Slicer, early, dark green gynoecious hybrid.
Liberty*	T	Pickle, resistant to scab and mosaic.
Marketmore 76	C	Marketmore 70 with improved disease resistance.
Pacer	H	Early, compare with Marketmore 70.
Pickle-riffic*	G	Pickle, early, high yield.
Poinsett 76	C	Uniform dark color. Tolerant to mildew, scab.
Premier*	A	Pickle, blocky, dark green.
Raider*	H	Early, gynoecious slicer, uniform color, SMR.
Saladin*	T	AAS, pickle, 4-5", 55 days. Disease resistant.
Score*	A	Pickle, cylindrical blocky shape, small seed cavity, dark green.
Sprint 440N*	A	Early slicer, 7-9" length, blocky and cylindrical, dark green, disease resistant.
Super Slice*	NK	Slicer, dark green, 64 days, 8-9" long, resistant to scab, tolerant CMV.
Sure Slice*	G	Excellent slicer, small seed cavity, good color.
#320	KY	Sweet and burpless, virus resistant.
EGGPLANT		
Black Bell	PS	Early, round, dark purple.
Imperial or French Imperial	PS	Early, long cylindrical, dark purple, Italian type.
Gator	A	Fruits blocky and cylindrical, dark glossy skin.
Satin Beauty*	BA	65 days, 2 weeks earlier than Black Beauty, for container growing.
Slim Jim	BA	70 days, for container and outdoor use.
Viserba	A	Fruit long and slender, glossy, nearly black.
ENDIVE		
Grower's Giant	A	Pale green, broad crumpled leaves.
KOHLRABI		
Grand Duke*	T	AAS, 50 days, tolerant to black rot.

(*continued*)

Variety or hybrid	Company	Brief descriptive notes
LETTUCE		
Citation	A	Medium large, solid head; thick and wavy, deep green leaves.
Deep Red	H	Red tinged leaves, slow to bolt.
Green Lake	J	Head lettuce, highly resistant to bolting. Developed at Univ. Wisc.
Montello	J	
Prado	R	A tender butterhead type.
Tania	H	High quality, dark green Boston type, resistant to four strains of mildew.
MUSKMELON		
Bushwhopper	P	Dwarf bush melon for home gardens.
Earli-Dew*	PS,BA	86 days, suitable for northern climates, green flesh, Honeydew.
Earlisweet	PS	Early for northern growers.
G25VB*	H	Gold Star type, earlier.
Gusto 45	A	Flesh firm and thick; small dry seed cavity; salmon-orange, very sweet.
Milky Way	KY	Early, Honeydew type, good flavor.
No. 45 SJ	A	Flesh thick and firm; hard, slightly ribbed; salmon-orange.
Shipmaster	NK	Resembles PMR-45, indistinct suture, well netted, salmon orange interior, small cavity.
Star Trek*	H	Gold Star type.
Summet	A	Flesh bright orange, thick and firm; small, dry seed cavity, sweet.
Sweet and Early	BUR	75 days, salmon flesh, small seed cavity, resistant to mildew.
ONION		
Aries*	A	Medium to large full globe, yellow-brown, pungent.
Fusario 24*	J	Two-way hybrid somewhat lower yield than F245.
Fusario 245*	J	Developed by Dr. Warren Gabelman, Univ. Wisc. for muck soils where fusarium is a problem. Hard yellow globe, excellent keeper.
Garnet*	A	Medium to large full globe, reddish brown, pungent
Inca*	A	Very large full globe, reddish brown, mild.
Matador*	N	Long day onion, performed well in Wisc. and Mich. on muck, medium size, deep globe, golden flesh, white, mild.
Ontario M*	A	Medium large, full globe, medium dark, pungent.
Pronto S*	A	Medium large, full globe, dark yellow, mild.
Rocket*	A	Medium large, full globe, medium yellow, pungent.
Sierra*	A	Large, deep globe, reddish brown, mild.
Taurus*	A	Medium large, blocky globe; yellow-brown color, very pungent.
Topaz*	A	Medium large, full globe; dark yellow, pungent.

(*continued*)

Variety or hybrid	Company	Brief descriptive notes
PEAS		
Mars	A	Medium size, blunt; dark green, excellent texture and flavor.
Patriot	HF,P	9-10 peas/pod, sets 2 pods/node, easy to shell, sweet and prolific.
Spring	A	Medium size, blunt and dark green.
Sugar Snap*	P,H	AAS, edible-podded snap pea. Home gardens.
Venus	A	Well filled pods, blunt; dark green, sweet.
PEPPER		
Anaheim TMR 23	PS	Hot, long TMV resistant.
Better Belle*	BA,PS	Early, blocky, thick walls, TMVR.
Big Bertha*	PS	Very large, long bell, thick wall, TMV resistant.
Dutch Treat*	T	AAS, Banana type, 3-5", turns orange to red.
Early Jalapeno	PS	Hot, very early, compact plant.
Early Prolific*	G	Early sweet pepper, small 3-lobed fruit.
Hybelle*	H	Good performance, high yields in south, TMV rest.
Market Master*	G	Extra large, blocky, heavy walls, TMV resistant.
Martindale	SS	Early bell, tolerant to TMV.
Park's Pot*	P	Dwarf pot bell pepper. Home gardens.
Pepperoncini	BA	Early, finger thick, 4-5" long.
Pip	A	Medium large to large in size, blocky oblong.
Sonnette	N	Maturity comparable to Yolo but longer fruit, 4-lobed, thick walls, processes well.
Super Shepherd	SS	Long Italian sweet pepper.
PUMPKIN		
Big Moon	PS	"Show type", very large (to 200 pounds) with pink-orange rind.
Funny Face	HF	Early, semi-bush, Jack o' Lantern.
Howden	H	Deep orange color, large, uniform, stores well.
Spirit*	HF	AAS, semi-vine, Jack o' Lantern.
RADISH		
Fancy Red	H	Bright red, multiple disease resistance.
Far Red	N	Red globe w/resistance to fusarium, aphanomyces, black root, rhizoctonia, and black scurf.
Inca	R	Smooth, round, red, firm white flesh.
SPINACH		
Grandstand*	A	Medium large, erect plants, semi-savoy leaves.
Highpack*	A	Large, semi-erect plants, smooth large leaves.
Kent*	A	Large, semi-erect plants, savoy leaves.
Marathon*	A	Large, semi-erect plants, savoy large leaves.
Melody*	R	AAS, long standing, crinkle, tender leaves, slow bolting.
Packer*	A	Large, erect plants, savoy; large leaves.
Seven R*	A	Large, erect plants, semi-savoy leaves.

(*continued*)

Variety or hybrid	Company	Brief descriptive notes
SQUASH (SUMMER)		
Black Eagle*	NK	50 days, black zucchini type, 7" length, white flesh, vigorous bush habit.
Castleblack*	C	Early, black-green zucchini.
Castlegrey*	C	Early, grey zucchini type.
Castle Gold*	C	Early, yellow straightneck, smooth, uniform shape.
Castle Verde*	C	Early, dark green zucchini, cylindrical, glossy.
Carcker	PS	Yellow crookneck, medium thick neck.
Daytona*	NK	41 days, yellow crookneck, 6" length, interior cream yellow, semi-open bush.
Gold Rush*	PS	Golden Zucchini, smooth, straight.
Gold Slice*	PS	Yellow straightneck, slender.
Golden Eagle*	NK	45 days, cream yellow straightneck, 7-8" length, open bush habit.
Golden Girl*	H	Yellow straightneck, excellent yields.
Gourmet Globe*	G,P	Unique round striped, most flavor of any zucchini.
Lemondrop L*	A	Tapered cylinder fruit shape, glossy, smooth, light lemon-yellow.
Patty Green Tint*	PS	Green scallops, small scar.
Posiedeon*	H	Early, dark zucchini type.
Senator*	A	Uniform cylindrical shape; glossy, medium dark green.
SQUASH (WINTER)		
Early Butternut*	J,HO,PS	AAS, early semi-bush habit, thick neck, extremely uniform, excellent texture.
Sweet Mama	Y	AAS, short vines, tolerant to FW and squash borer.
Table Ace*	PS,J,H	Early, dark acorn, semi-bush type.
SWEET CORN		
Aztec*	A	Early, excellent flavor.
Beacon*	R	Early, tender kernels.
Burgundy Delight*	S	73 days, bicolor ears, 7-8" long, burgundy stalk.
Burpee's Sugar Sweet*	BUR	89 days, yellow.
Calico*	A	Bicolor, large ears, tender and sweet.
Carmelet*	S	72 days, 8-9" ears, high eating quality, good tip fill.
Cherokee*	A	Well filled w/small bright yellow kernels.
Comet*	A	White, medium ears; good table quality.
Commander*	A	Large eared; extra tender, sweet flavor.
Dawn*	NK	74 day maturity, 12-14 rows, 7½ to 8½" length, good husk, attractive freezer.
Earligem*	S	Early, 64 days.
Early Xtra Sweet*	I	Early, high sugar, slow conversion.
Florida Staysweet*	I	Midseason, very uniform, high sugar, slow conversion.
Gold Lady*	S	82 days.
Golden Gleam*	H	90 days, vigorous, field tolerance to MDMV.
H445*	H	88 days, vigorous, attractive husk, field tolerance to MDMV.

(*continued*)

Variety or hybrid	Company	Brief descriptive notes
SWEET CORN (continued)		
Illini Xtra Sweet*	I	Midseason, high sugar, slow conversion.
Kandy Korn E.H.*	HF	Sweet, ability to hold at optimum maturity for 10-14 days, yellow.
Lancer*	S	80 days, 8" ear, deep kernels, suited for mechanical harvest, good early vigor.
Merit*	A	Large ears, well filled, excellent flavor.
NCX 2009*	N	Late, looks good in Florida and the East. Good flag leaves and dark green husk cover.
NCX 2019*	N	75-day hybrid w/bright yellow, tender kernels. Good flag leaves and tip cover, looks good in trials in the East and Wisconsin.
Quick Silver*	H	75 days, white, attractive ear, excellent quality.
Resister*	N	Main season, yellow, 8½" ears, tolerant to head smut, sugar cane mosaic, MDMV.
Slendergem*	S	76 days, 8-9" ear, high quality, good vigor in cold soils.
Starlet*	S	75 days, yellow kernels, 8-9" ears, good resistance to Stewart's wilt.
Sugar Loaf*	NK	83 days, 16 rows, 8" length, retains sweetness through freezer storage.
Sweet Sal*	H	86 days, bicolor, field tolerance to MDMV and rust, excellent quality.
Xtra Sweet 77*	I	Early, excellent seedling vigor, high sugar, slow conversion.
YW 75*	H	80 days, bicolor, field tolerance to MDMV and rust, excellent quality.
TOMATO		
Ace 55 VF	A	Large, heavy, firm, smooth, free from cracking.
Better Girl*	BUR	78 days, indeterminate, large, VF.
Bragger*	G	Large beefsteak type.
Castlehy 101*	C	Early, medium large fruit, VF.
Castlehy 105*	C	Large vine for staking, firm.
Castlehy 1015*	C	Cherry, dwarf vine, dark rugose foliage.
Castleprize*	C	Early, large, smooth fruit, VFN.
Castlex 1018*	C	Large, firm, smooth fruit, medium vine, VF.
Castlex 1025*	C	Medium, firm, smooth fruit, medium vine, suitable for staking.
Castlex 1032*	C	Medium large fruit, large vine for staking, VFN.
Early Cascade	PS	Home garden staked tomato, firm, medium sized, early and continues until frost.
Flora-Dade	FF	Medium, determinate, fresh market.
Floramerica*	J	AAS, disease resistant, large.

(*continued*)

LIST OF NEW VEGETABLE VARIETIES (*continued*)

Variety or hybrid	Company	Brief descriptive notes
TOMATO (continued)		
Godfather*	HE	Large, determinate, home gardens, VF.
Goldie*	P	Yellow dwarf, home gardens, hanging baskets.
He Man*	G	Large fruited midseason.
Main Pak*	H	Deep, firm fruit, VF resistance
Plum Delicious	J	Plum tomato w/taste.
Royal Red	C	Cherry, large vine for staking, exc. flavor, VF.
Show-Me	UM	Main season, firm, crack resistant, indeterminate.
Sugar Lump	J	Cherry type, sweet juicy, just right size for whole pack. A notch above many blander paste types.
Sweet 100	G	Unique cherry, high yields, high in Vit. C., sweet.
Sweet-N-Early*	BA	Early good tasting tomatoes, clusters of 7-9, VF.
Tempo*	A	Medium to large, flattened globe, smooth, firm.
"The Juice"*	BA	50 days, juice tomato, 6-8 oz, determinate, VF.
Westover	UMY	Medium size, determinate, suitable for cages.
Winner	A	Medium to large, full globe, smooth, rich, red, sweet
TURNIP		
Royal Crown*	NK	Purple top white globe, lower portion of root white w/attractive purple top, uniform w/extreme vigor.
WATERMELON		
Blue Belle*	A	Round, dark green tough rind; orange-red color, very fine texture and sweet.
Imperial	PS	Crimson Sweet type, excellent color and flavor, fusarium tolerance.
Improved Triple Sweet*	AS	Seedless with improved resistance to fusarium and anthracnose, 16-18 pounds. Seed limited, written report required.
Iopride	IA	Compares favorably Crimson Sweet, 25 pounds.
Kengarden	G	Bush watermelon, 10-12 pounds, developed at Univ. of Ky., adapted to South.
New Dragon	KY	Early medium Blue Ribbon type.
Panonia	SS	Sugar Baby type.
Park's Whopper	P	Low fiber, sweet red flesh, thin dark rind.
Picnic	A	Oblong, medium green tough rind; orange-red, firm texture and sweet.
Polycross #1*	AS	High quality seedless, improved fusarium and anthracnose resistance, 18-20 pounds. Seed limited, written report required.
Prince Charles	PS	Charleston Gray type, large uniform fruit, bright red, black seeds.
Sunshade	A	Oblong, light green tough rind, bright pink-red, crisp and sweet.
Sweet Favorite	T	AAS, 82 days, rest. to anthracnose and fusarium, 20 1
Sweetmeat II	PS	Medium green skin with dark green stripes, excellent flesh and flavor.
Yellow Baby	KY	AAS, early, yellow flesh, good quality.

SOURCES OF NEW VARIETIES

We acknowledge the following companies and seedsmen for the information in this report:

A	Leo J. Zanoni, Asgrow Seed Co., Kalamazoo, MI 49001
AS	O. J. Eigsti, American Seedless Watermelon Seed Corp., Goshen, IN 46526
BA	Jan P. Umstead, Ball Seed Co., Box 335, West Chicago, IL 60185
BUR	W. Atlee Burpee Co., Box B-2001, Clinton, IA 52732
C	Dr. F. F. Angell, A. L. Castle, Inc., Box 877, Morgan Hill, CA 95037
FF	Florida Foundation Seed Producers, Inc., Gainesville, FL 32601
G	Glen Goldsmith, Goldsmith Seeds, Inc., Gilroy, CA 95020
H	Wilbur Scott, Joseph Harris Co., Inc., Moreton Farms, Rochester, NY 14624
HE	Herbst Brothers, Inc., 1000 N. Main St., Brewster, NY 10509
HF	Henry Field Seed & Nursery Co., Shenandoah, IA 51601
HO	Holmes Seed Co., Box 9087, 2125 46th St. NW, Canton, OH 44709
I	Floyd Ingersoll, Illinois Foundation Seeds, R-1, Tolono, IL 61880
IA	Iowa State University, Muscatine Island Field Station, Fruitland, IA 52749
J	Ken Kmiecik, J. W. Jung Seed Co., Randolph WI 53956
KY	Known-You Seed Co., 26 Chung Cheng 2nd Road, Kaohsiung, Taiwan
MSU	Dr.S. Honma, Michigan State University, East Lansing, MI 48823
N	Tom Williams, Niagra Seeds, FMC Corp., Seed Department, Box 3091, Modesto, CA 95353
NK	Iver Jorgensen, Northrup King & Company, 1500 Jackson Street, N.E., Minneapolis, MN 55413
P	George W. Park Company, Inc., Greenwood, SC 29646
PS	Paul Thomas, Petoseed Company., Inc., Box 4206, Saticoy, CA 93003
R	John Brewer, Rogers Brothers Seed Company, Box 2188, Idaho Falls, ID 83401
S	George Oswald, Seedway, Inc., Hall, NY 14463
SS	Stokes Seeds, Inc., Box 548, Buffalo, NY 14240
T	Otis S. Twilley, Box 1817, Salisbury, MD 21801
UM	Dr. Victor Lambeth, University of Missouri, Columbia, MO 65201
UMY	Dr. John Bouwkamp, Department of Horticulture, University of Maryland, College Park, MD 20742

UNIVERSITY OF ILLINOIS AGRICULTURAL NEWSLETTER SERVICE[1]

Newsletter	Contents	Number of issues	Subscription cost[2]
Farm Economic Facts and Opinions	Economic principles applied to farm problems as pricing strategy, crop production costs and market outlook.	12	$ 4.50
Illinois Farm and Food Outlook	Anticipates reports and interprets current market information--supply, demand and price outlook--for agricultural products.	50	12.00
Agronomy News	Timely information on crops and soils.	10	3.00
Bees & Honey	Timely tips on bees, honey production and management.	10	4.00
Insect, Weed and Plant Disease Survey Bulletin	Weekly reports on situation and recommendations for control of insects, weeds and plant diseases.	20	7.00
Spray Service Report	Provides information on commercial fruit culture, insect and disease problems and recommended control measures.	18	5.50
Illinois Vegetable Farmer	For commercial vegetable growers; growing, production and marketing conditions and legal aspects.	9	5.00
Home, Yard and Garden Pest Newsletter	Provides timely information on insect, weed, and plant disease pests of the home, yard, and garden. Details are given on current control procedures, application equipment and methods, safe storage and disposal of pesticides, plus other topics of interest.	20	6.00
Illinois Irrigation Newsletter	Presents information on new irrigation techniques and equipment and some in-depth treatment of specific topics of interest to irrigators.	10	3.50

[1]Make check payable to: University of Illinois Agricultural Newsletter Service. Mail to: University of Illinois, Agricultural Newsletter Service, Cooperative Extension Service, 116N Mumford Hall, Urbana, Illinois 61801. Newsletters on other subject matter (i.e., swine, beef, dairy, vet topics, etc., also available)
[2]January 1 subscription date.

Herbicide Guide 1979

FOR COMMERCIAL VEGETABLE GROWERS

You must be certified as a pesticide applicator to use restricted-use pesticides. See your county Extension adviser in agriculture for information.

Weed growth reduces the income of vegetable growers in the United States by millions of dollars annually as a result of lower yields, poorer quality, and added labor in harvesting and processing.

This guide should be used together with the grower's knowledge of soil types and the crop and weed history of the area to be treated. Whether to use herbicides or other means of weed control depends in part on the severity of past weed infestations. In many instances mechanical control is sufficient, or it may be needed in addition to herbicide use. Several herbicides may be suggested for some crops. These herbicides have shown good control with no injury to the vegetables under test conditions. Not all herbicides cleared for use on a species are necessarily listed. Where the choice of more than one herbicide is suggested, the decision rests with the grower and is based on his knowledge of past weed infestations, crop rotations, and material costs. Where one herbicide will not control the weeds present, a combination of herbicides may be suggested. When using a herbicide for the first time, use a small-scale trial.

These suggestions for chemical weed control in vegetables are based on research at the Illinois Agricultural Experiment Station, the U.S. Department of Agriculture, and other research institutions. The University of Illinois and its agents assume no responsibility for results from the use of these herbicides, whether or not they were used in accordance with suggestions, recommendations, or directions of the manufacturer or any governmental agency.

Reading the label of the herbicide container is the most profitable time you spend in weed control. Use of the material and methods of application and use depend on registration of the herbicide by federal and state Environmental Protection Agencies (EPA). Do not use any herbicide *unless the label states that it is cleared for the use on the crop to be treated.*

Herbicides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. A person wishing to use a herbicide classified for restricted use must be certified as a private or commercial pesticide applicator by the Illinois Department of Agriculture. Contact your county Extension adviser in agriculture for details on this program. Only a few herbicides have been classified at this time. More will be classified later. Herbicides bearing a restricted-use classification are identified by an asterisk (*) in this circular.

Where mixtures of chemicals are applied, the *user* will assume the responsibility for freedom from residues if such applications are not labeled by the EPA as a mixture.

Suggestions sometimes change during the growing season, based on EPA clearances that were made after this circular was issued. This publication, printed once a year, is subject to change without notification.

Watch for notice of changes in the EPA registration of herbicides (as released by the EPA) in the *Illinois Vegetable Farmer's Letter.* A subscription form for this newsletter is available from 116 Mumford Hall, University of Illinois, Urbana 61801.

Note: In the suggestions given on the following pages, the trade names of the herbicides are usually used. The list below shows trade names and their corresponding common names.

Common name	Trade name	Common name	Trade name	Common name	Trade name
alachlor	Lasso	cycloate	Ro-Neet	metribuzin	Lexone, Sencor
atrazine	AAtrex and others	dalapon	Basfapon, Dowpon	naptalam	Alanap
benefin	Balan	DCPA	Dacthal	nitrofen	TOK
bensulide	Prefar	dinitramine	Cobex	paraquat*	Paraquat*
bentazon	Basagran	dinoseb	Premerge-3, Sinox	profluralin	Tolban
butylate	Sutan+	diphenamid	Dymid, Enide	propachlor	Bexton, Ramrod
CDAA	Randox	diuron	Karmex	pyrazon	Pyramin
chloramben	Amiben, Vegiben 2E	EPTC	Eptam, Eradicane	simazine	Princep
chlorbromuron	Maloran	glyphosate	Roundup	trifluralin	Treflan
chlorpropham	Furloe	linuron	Lorox	Petroleum solvent	Stoddard Solvent
cyanazine	Bladex	MCPA, MCPB	(numerous ones)	2,4-D (amine)	(numerous ones)

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
Prepared by H. J. Hopen, Department of Horticulture (revised annually) CIRCULAR 907 (October, 1978)

Crop	*Treatment*	*Active ingredient per acre actually covered*[1]	*Weeds controlled*	*Best time of application (based on crop stage)*	*Remarks, cautions, limitations*
Asparagus (seedlings)	Amiben	3 lb.	Annuals	Immediately after seeding	Irrigation or rainfall after treatment will give n control.
Asparagus (established plantings)	dalapon	5-10 lb.	Perennial grass	End of harvest season following disking	Apply when grass weeds are 3 to 4 inches tall. Dir under fern growth. Use surfactant as directed on
	Karmex	1-4 lb.	Annuals	In spring and/or after harvest	Apply after disking. Do not exceed 6 pounds per season. Use a lighter rate on sandy soil. With Kar Princep, a spring application may be sufficient first year.
	Princep	3-4 lb.	Annuals	In spring and/or after harvest	Apply after disking. Do not treat during the las asparagus because of residue.
	metribuzin	1-2 lb.	Primarily broad-leaf weeds	Early spring before the spears emerge	Apply after disking. Do not apply within 14 day vest. Can help control broadleaf weeds when u dalapon, Karmex, or Princep.
	Stale seedbed, before crop emergence (see page 5)				
	Preemergence				
Beans, dry, lima, and snap	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Plant crop immediately, or within 3 weeks after ap Can be used up to 1 pound per acre on dry bear
	Tolban	0.5-1 lb.	Primarily annual grasses	Preplant soil incorporation	
	Premerge-3	6-7.5 lb.	Annuals	Can be used between planting and crop emergence	Do not use on light, sandy soil. Some stand reduc result from use. See label for precautions.
	Postemergence				
	Basagran	0.75-1 lb.	Annual broad-leaf weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after the first trifoliate leaf appears on beans	Can provide good, broad-spectrum control when c with a grass-active herbicide. Do not mix with o ticides. See Basagran entry under corn, postemer Canada thistle and nutgrass control.
Beans, lima and dry	Amiben	2-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	Field may be rotary-hoed without destroying action.
Beans, snap	Eptam	3 lb.	Annual grasses and nutgrass[3]	Preplant soil application, incorporate with soil immediately	
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	Do not feed treated plant parts to livestock.
	Vegiben 2E (2E form *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	This ester form of chloramben may leach less rea sandy soils. Least effective on sandy soils.
Beans, dry	Cobex	0.3-0.6 lb.	Annuals	Preplant soil incorporation	
Beets, garden	Pyramin	4 lb.	Annuals (primarily broadleaved)	Preemergence or after beets emerge and before weeds have two true leaves	Rainfall or irrigation needed to activate. Where g a severe problem, use 4 pounds of Pyramin plus of Ro-Neet.
	Ro-Neet	4 lb.	Annual grasses	Preplant soil application, incorporate with soil immediately	Use a combination treatment with Pyramin to control spectrum.
	Preemergence — direct-seeded or transplanted				
Broccoli Brussels sprouts Cabbage Cauliflower	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Stunting or growth reduction may occur at recor rates under growth stress conditions. Can be use pound per acre on transplants.
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding. Can also be incorporated preplant	
	Postemergence — direct-seeded or transplanted				
	TOK[5]	3-6 lb.	Broadleaved weeds[6]	One to two weeks after crop emergence or transplanting, while weeds are in seedling stage	Use wettable-powder formulation to reduce injur tial. Use in combination with preplant or pree material for annual grass control.
	Preemergence				
Carrots	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Seed after application to 3 weeks later.
	Postemergence				
	Lorox	0.75-1.5 lb.	Annuals	Postemergence on carrots only after the crop is 3 inches tall; grasses, less than 2 inches; broadleaves, less than 6 inches	Do not feed treated foliage to livestock or replan area for 4 months. More than one application may but do not exceed a total of 2 pounds per acre. D over 40 PSI. Use no surfactants when temperatur 80°F., or crop injury may result.
	TOK	3-6 lb.	Broadleaved weeds[6]	While weeds are in the seedling stage	Can also be used on celery and parsley. Use in com with preplant or preemergence material for ann control.
	Stoddard Solvent	60-80 gal.	Annuals	After two true leaves have appeared (do not apply to carrots or parsnips after they are ¼ inch in diameter, since an oily taste may result)	Most effective when sprayed on cloudy days or du humidity, and when weeds are not more than 2 inc May not control ragweed. Do not apply within 4 harvest. Can also be used on celery, dill, parsr parsley.

See footnotes on page 108.

p	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Best time of application (based on crop stage)	Remarks, cautions, limitations
	Preemergence				
p)	atrazine	2-3 lb.	(See sweet corn)	(See sweet corn)	See sweet corn, *except the section on preemergence combinations.*
	Princep	2-3 lb.	Annuals	Preemergence	Plant only crops so specified on the label the following year. Do not graze treated areas.
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	See sweet corn.
	Postemergence				
	2,4-D	0.5 lb.	Broadleaved weeds	Postemergence	Apply when corn is 3 to 10 inches tall.
	Roundup	2-3 lb.	(See remarks)	(See remarks)	Use for quackgrass or Johnsongrass control. Apply to quackgrass when 6 to 8 inches tall in fall or spring. Apply to Johnsongrass when at least 12 inches tall and actively growing. Do not till until 3 to 7 days after application.
	Preemergence				
eet	atrazine	2-3 lb.	Annuals, annual and perennial grasses[7]	Preemergence, apply no later than 3 weeks after seeding Shallow cultivation may improve weed control during dry weather	Grow corn a second year without atrazine treatment. This chemical has a high soil residue. Do not plant other vegetable crops on a sprayed area until a second year of corn has been grown. Use atrazine where quackgrass is a problem. Residue hazard decreased when banded or in combination with Lasso, propachlor, or Sutan.
	Bladex	(See remarks)	Annuals	Preemergence only	Some sweet corn varieties are sensitive to the application rate. Has been shown to have less soil residual than atrazine. See label for rates and precautions. Do not use postemergence, or on sandy or loamy-sandy soils. Can be combined with other herbicides to reduce the rate being used.
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	Use to control weeds that are difficult to control with other herbicides, such as wild cane, nutsedge, quackgrass, and seedling Johnsongrass.
	Lasso	2-2.5 lb.	Annuals	Preemergence	Preplant incorporation may aid control of nutgrass.
	propachlor	4-5 lb.	Annuals	Preemergence	Do *not* use on sandy soils. Is an excellent herbicide on soils with a high organic-matter content.
	Sutan +	3-4 lb.	Primarily annual grasses	Preplant soil application Incorporate with soil	Use on sandy soil and where nutgrass is a problem.
	Preemergence combinations				
	atrazine plus Lasso	1.5 lb. +2 lb.	Annuals and perennial grasses	Preemergence or preplant incorporated	See label for slightly higher rate of Lasso for preplant incorporation.
	atrazine plus propachlor	1.5 lb. +3 lb.	Annuals and perennial grasses	Preemergence	Use to reduce atrazine residue.
	atrazine plus Sutan +	1 lb. +3-4 lb.	Annuals and perennial grasses	Preplant soil incorporation Incorporate with soil immediately	Use where nutgrass is a problem and to reduce atrazine residue.
	Postemergence				
	2,4-D (amine)	0.5 lb.	Broadleaved weeds	Postemergence	Preferably, apply before corn is 6 inches tall. If corn is over 12 inches, reduce the rate to ¼ pound.
	atrazine	2 lb.	Annuals, annual and perennial grasses[7]	Directed spray 3 weeks after emergence	Can be combined with crop oils for postemergence application as an emergency measure. This may increase residue the following year. Preemergence use preferred. Do not graze or feed treated foliage for 21 days after treatment.
	Basagran	0.75-1 lb.	Broadleaved annual weeds, Canada thistle, and nutsedge	Early postemergence when the weeds are small and actively growing. Delay will result in less control	For Canada thistle and nutsedge, split applications are preferred. Make the first one when the plants are 6 to 8 inches tall; for nutsedge, 7 to 10 days later; for Canada thistle, 10 to 14 days later (or use one application plus cultivation). Do not mix with other pesticides.
	Perennial grass control, applications outside the growing season (see page 5)				
pers elons	Alanap[8]	3-5 lb.	Annuals[3]	Immediately after seeding or transplanting	Do not use on cold soil. Rainfall or irrigation after treatment gives maximum control.
nelons		3-3.5 lb.		After transplanting or vining	Use the granular form. Keep away from foliage. Apply to soil after the weeds have been removed.
	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Is primarily a grasskiller. Consult label for sensitive crops within 18 months after application. Prefar can be used in rotation with tomatoes, broccoli, cauliflower, lettuce, carrots, onions, and summer squash within 18 months of application.
	Prefar plus Alanap[8]	4 lb. +2-3 lb.	Grasses and broadleaved weeds	Preplant soil incorporation for Prefar; Alanap, as an immediate postseeding application	Has value for broad-spectrum weed control. Consult label for sensitive crops within 18 months after Prefar application. Has EPA approval as a tank mixture.
	Vegiben 2E (2E form *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	This ester form of chloramben may leach less readily in sandy soils. Above 1.5 to 2 pounds per acre, injury chances increase under moist soil conditions. Some muskmelon cultivars may be susceptible to Vegiben injury.
	As an alternative to herbicides where earliness is desired, black polyethylene mulch will control annual weeds, conserve moisture, and increase early spring soil temperatures.				

otnotes on page 108.

SUGGESTIONS FOR 1979 ONLY

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Best time of application (based on crop stage)	Remarks, cautions, limitations
Eggplant	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	After plants are established, 4-6 weeks after transplanting	Cultivate and weed prior to application. Can to plants as part of a uniform soil application.
Greens	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	For use on collards, kale, mustard greens, and t
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application. Incorporate with soil immediately	For use on collards, kale, mustard greens, and tur
	Furloe	1-2 lb.	Primarily broadleaved annuals	Preemergence	For spinach only. Use lower rates in cool, wet
Horseradish	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after transplanting	Use for annual grass control and combine with early postemergence treatment for broadleaved
	TOK[5]	3-6 lb.	Broadleaved weeds[6]	Before weeds are 1 inch high	Will not consistently control weeds over 1 inch emerging annual grass may be controlled by this Lower rate will control seedling purslane.
Lettuce	Balan	1.5 lb.	Annuals	Preplant soil incorporation Incorporate with soil immediately	Is primarily a grasskiller. Seed after application later. Do not plant wheat, barley, rye, grass, or beets, or spinach for 12 months after applicatior
Onions	**Preemergence** Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding or transplanting	May not kill smartweed or common ragweed. C on seeds, sets, or seedlings. Use only on minera lower rates on sandy soils. A double application can be used at seeding, layby, or both. In most the weed spectrum on mineral soils will respon combination of Dacthal preemergence and TOK gence.
	Randox	4-6 lb.	Annuals[9] (primarily grasses)	Just before onions emerge	Use on muck soils. Heavy rainfall may reduce s effective on purslane and pigweed.
	Postemergence TOK	3-4 lb.	Broadleaved weeds	When weeds are in the seedling stage and not over 1 inch high	Use a single application of E.C. or W.P. per grow Do not apply E.C. until onions are in the two- t stage. *Preemergence* use of TOK with heavy rainf duce stand. Use in combination with preplant c gence material for annual grass control.
	Furloe	3-6 lb.	Broadleaved weeds (especially smartweed)	On seeded onions: loop stage or after 3- to 4-leaf stage	In the later sprays, direct at base of onion pla than one application is applied do not exceed 6 acre for the season. *Use lower rates in cool, wet u* no later than 30 days before harvest.
Peas	**Preemergence** propachlor	4-4.9 lb.	Annuals	Preemergence	Do *not* use on sandy soil.
	Treflan	0.5-0.75 lb.	Annuals[2]	Preplant soil incorporation Incorporate with soil immediately	Seed after application to 3 weeks later. Some r growth and stand reduction possible under s suppress some root rot.
	Cobex	0.3-0.5 lb.	Annuals	Preplant soil incorporation	
	Preemergence or Postemergence Premerge-3	0.3-9 lb.	Annuals (primarily broadleaved weeds)	Preemergence or postemergence	Preemergence use 6 to 9 pounds; postemergen pound to 1.1 pounds. Apply prior to bloom wh 2 to 8 inches tall. See label for further precau emergence use may help suppress root rot.
	Postemergence Basagran	0.75-1 lb.	Annual broadleaf weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after peas have 3 pairs of leaves (or 4 nodes)	Can help control Canada thistle. Can provide g spectrum control when used with a grass-activ Do not mix with other pesticides. See Basagran corn, postemergence for Canada thistle and nu trol.
	MCPB	1 lb.	Broadleaved weeds and Canada thistle	When peas are 3-7 inches tall and no later than 4 nodes prior to pea blossom	May delay maturity 1 to 4 days. Use at least of water per acre. Do not feed vines to livestock. MCPA is more effective on mustard. MCPB jurious to peas.
	MCPA	0.25-0.5 lb.			
Potatoes, Irish	Eptam	3-6 lb.	Annual grasses and nutgrass[3]	Drag-off treatment at emergence or preplant soil application Incorporate with soil immediately	Use lower rate on sandy soil.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Drag-off treatment at emergence	Use a light incorporation.
	Lorox	0.75-2 lb.	Annuals	Apply prior to potato emergence	Plant tubers at least 2 inches deep. Do not repl area to other crops for 4 months after treatme jure crop on light, sandy soil. Do not apply o tubers.

[1] Based on active ingredients (actual amount of active herbicide in material or acid equivalent). Use lower rate on sandy soil and higher rate on clay and loam using a band application over the row, adjust amount of material applied to the part of an acre treated. See Illinois Circular 1047. [2] May not control ragweed [3] May not control smartweed. [4] May not control ragweed, smartweed, and velvetleaf. [5] Use of 50% wettable powder is suggested for cabbage and horseradish. [6] Ma ragweed or chickweed. Grass control is sometimes marginal. [7] May not control crabgrass. [8] Do *not* use Alanap Plus, Solo, Whistle, or Amoco Soybean herbicide. Th all contain Alanap plus another ingredient that may cause injury. [9] May not control smartweed and velvetleaf.

(cro)p	*Treatment*	*Active ingredient per acre actually covered*[1]	*Weeds controlled*	*Best time of application (based on crop stage)*	*Remarks, cautions, limitations*
toe (c t.)	chlorbromuron	2-3 lb.	Annuals	At very start of potato emergence	May injure crop on light, sandy soil. Do not harvest immature potatoes. Do not plant crops other than field corn, potatoes, or soybeans for 6 months after applying.
	dalapon	7 lb.	Quackgrass	Before plowing in spring; wait 4 days before plowing and planting	Not for fields intended for red-skinned varieties or White Rose. Do not plant potatoes for 4 weeks. Use surfactant as directed on label.
	metribuzin	0.25-0.5 lb.	Annuals (primarily broadleaved)	Postemergence, following a preemergence grass herbicide	Can be used preemergence also. Do not exceed 1 pound per acre in a season. Do not apply within 60 days of harvest. Do not use on red-skinned or early maturing white varieties. Do not apply in cool, wet weather.
	Lasso	2.5-3 lb.	Annuals	Apply at drag-off	Do not use on sandy soils. Can be used alone or in combination with Lorox or dinoseb.
oe	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after planting	Preferred on sandy soil.
	Amiben	3 lb.	Annuals	Immediately after planting	Preferred on loam soils.
cl	Furloe	1-2 lb.	Annuals	Immediately after seeding	Use 1 pound if the temperature is below 60°F.
h ks	Amiben	3-4 lb.	Annuals	As soon after seeding as possible	Use on loam soils. In Illinois, Amiben can be applied broadcast or banded over the row in pumpkins.
sh	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application Incorporate with soil immediately	Is primarily a grasskiller. Consult label for sensitive crops within 18 months after application. Prefar can be used in rotation only with tomatoes, broccoli, cauliflower, lettuce, carrots, onions, and summer squash within 18 months of application. Use in combination with Alanap as suggested for cucumbers.
ates, t-eded	Dymid, Enide	4-6 lb.	Annuals	Preemergence	Do not plant other food crops on treated areas for 6 months. If used under dry soil conditions, a shallow (1 inch) incorporation as a preplant treatment may improve weed control. Can also be used on transplanted tomatoes and peppers.
aes pers, nted	Amiben	3-4 lb.	Annuals	Wait 3 days after transplanting to apply	Use granular formulation only. Apply to dry foliage in order to avoid leaf burn. Do not use on sandy soils.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application Incorporate with soil immediately	Some reduction of growth may be possible under growth stress conditions, or if rates are higher than suggested for the soil type.
	Sencor	0.25-1 lb. (min.-max.)	Primarily broadleaf. Should be used with a grass-active herbicide.	Preplant incorporated. Postemergence, can be broadcast or directed.	Apply with ground equipment to seeded and transplanted tomatoes. Do not use air-blast or other high-pressure spray equipment.
		0.25-0.5 lb.		Preplant incorporated, transplant tomatoes	Alone or in a tank-mix combination with Treflan.
		0.25-0.5 lb.		Broadcast spray, established tomatoes	Single or multiple applications. Minimum of 14 days between treatments. Direct-seeded plants should have 5 or 6 leaves; transplants should show new growth.
		0.5-1 lb.		Directed spray, established tomatoes	Recommended for use in fields with severe weed problems, or for fields with hard-to-control weeds.
		(For min.-max. rates)			Do not apply within 7 days of harvest. Do not apply within 3 days following periods of cool, wet, or cloudy weather; otherwise, crop injury may occur. Do not apply to established tomatoes within 24 hours after the application of other pesticides. Do not tank-mix with other pesticides, except Treflan. Do not apply more than 1 pound per acre per crop season, or more than 1 pound per acre within a 35-day period. Allow at least 14 days between applications, regardless of the dosage or method used. Do not use hot caps on tomatoes within 7 days before application, or at any time afterward.
	Stale seedbed, before crop emergence				
gus	Paraquat*	0.5-1 lb.	All emerged green foliage	Before crop emergence; allow maximum weed emergence prior to treatment	Weeds that emerge after treatment will not be controlled. Crop plants that have emerged at application will be injured. Do not apply within 18 months of harvest.

*Restricted-use herbicide.

(cro)p	Treatment	Active ingredient per acre actually covered	Weeds controlled	Best time of application	Remarks, cautions, limitations
	Perennial grass control, applications outside the growing season				
sweet	Roundup	2-3 lb.	(See remarks)	(See remarks)	Use for quackgrass or Johnsongrass control. Apply to quackgrass when 6 to 8 inches tall in fall or spring. Apply to Johnsongrass when at least 12 inches tall and actively growing. Do not till until 3 to 7 days after application. Does not provide residual weed control. Do not mix, store, or apply Roundup spray solutions in galvanized steel or unlined steel containers (except stainless steel) or spray tanks.

otnotes on page 108.

1979 Suggested Fungicide Guide | Fungicide Guide for COMMERCIAL VEGETABLE GROWERS

Vegetable fungicide tolerances and intervals approved by the Food and Drug Administration and the Environmental Protection Agency as of October 1, 1977, are presented in this publication. The tables on pages 2 and 3 give the tolerances in parts per million (ppm) and the number of days between the last application at normal rate and the harvest *or* they give the date of last application that will keep residues within tolerances set by the FDA.

The listing of a chemical for a crop does not necessarily constitute recommendation for control of a disease on that crop by the Illinois Cooperative Extension Service or the Agricultural Experiment Station. Specific recommendations are given on pages 4 to 7.

In some instances a tolerance (ppm) has been set but a definite interval has not been established. The absence of an interval does not necessarily mean that the fungicide may not be used on that crop. Use of the fungicide would require such restrictions as "do not apply after first blooms appear" or "do not apply after edible parts form."

In a few cases the interval and dosage have been established, but the allowable ppm residue has not been determined. Here again this does not mean that th fungicide may not be used on that crop. It does mear however, that until a tolerance is established it must b considered to be zero. Zero tolerances are reviewed eac year. Some are cancelled as the manufacturer supplic the EPA with additional data.

Growers must follow a disease control program thε will assure the production of vegetables with no excessiv fungicide residues. Vegetables marketed with residue exceeding FDA tolerances may be injurious to cor sumers, may be confiscated, and may cause the growe to be brought to court.

Growers have nothing to fear from the law so lon as they use fungicides and other pesticides according t the current label only on the crops specified, in th amounts specified, and at the times specified. The saf grower keeps a record of the products and trade name used, the percentage of active ingredients, dilution rates of application per acre, and dates of applicatio The record sheet provided on page 8 is a convenier place to keep such information.

This circular is revised each year. Be sure you hav the most up-to-date copy.

Prepared by Barry Jacobsen and M. C. Shurtleff, Department of Plant Pathology

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVIC
Urbana, Illinois Circular 999 (revised annually) November, 197

FUNGICIDE USES FOR VEGETABLES, APPROVED BY THE EPA, OCTOBER 1, 1978[a, b]

Crop	Benlate, 0.2-15 ppm	Captan (D) (See ppm below)	Bravo, 0.1-15 ppm	Difolatan, 0.1-15 ppm	Dyrene, 10 ppm	maneb, 4-10 ppm maneb with zinc salt	mancozeb[c] (See ppm below)	zineb, 4-25 ppm
sparagus	..	root dip	..	..	..	A[d]	(0.1 ppm), A	A
eans (dry, lima, snap) lima	14,[e] B (snap only) 28	(25 ppm), pp, 0[e]	7,[e] B (snap only)	..	..	0[e] 4 on limas or snap	..	7[e]
eet, garden	.	(2 ppm-root, 100 ppm-greens), 0, pp	..	..	..	..	..	7(tops)
roccoli	..	(2 ppm), pp	0[e]	..	..	(10 ppm), 3 or trim and wash	..	7
russels sprouts	..	(2 ppm), pp	0	..	..	7	..	..
abbage	..	(2 ppm), pp	0	..	..	(10 ppm), 7	..	7
antaloupe (muskmelon)	0	(25 ppm), 0, ph,[d] pp	0	0[e]	0[e]	5	(0 ppm in edible parts), 5[e]	5
arrot	..	(2 ppm), 0	0	..	..	(7 ppm), 0	(2 ppm) 7, B (tops)	7(tops)
auliflower	..	(2 ppm), pp	0	..	..	0	..	7
elery	(3 ppm), 7	(50 ppm), 0, pb	7	..	0	(5 ppm), strip and wash, 14	(5 ppm), 14	strip and wash, 14
hinese cabbage	..	..	..	..	..	..	..	7
orn, sweet and pop	..	(2 ppm), 10, B, pp	14, B[f]	..	..	..	(0.5 ppm-cob and kernel), 7 (5 ppm-fodder and forage, 0.5 ppm-ears)	0, B, C
ucumber	(1 ppm), 0	(25 ppm), 0, ph, pp	0	0	0	(4 ppm), 5	(4 ppm), 7	5
Eggplant	..	(25 ppm), 0, ph, pb	..	..	..	0	..	0
Endive, escarole	..	..	..	..	..	(10 ppm), 7 and wash	..	10
Fennel	..	..	..	..	..	..	7	..
Kale, collard	..	(2 ppm), pp	..	..	..	(10 ppm), 10 and wash	..	10
Kohlrabi	..	..	..	..	..	0	..	(halfgrown)
Lettuce	..	(100 ppm), 0	..	..	..	(10 ppm), 7 (strip and wash)	..	10
Mustard greens	..	(2 ppm), pp	..	..	..	(10 ppm), 10 and wash	..	10
Onion	..	(50 ppm green, 25 dry), 0, ph	0	0	0	(7 ppm), 0	(0.5 ppm dry), 7, D	10
Peas	..	(2 ppm), pp	..	..	..	..	..	10, C
Pepper	..	(25 ppm), 0, pb, pp	..	..	..	(7 ppm), 0	E	0
Potato, Irish[d]	..	(25 ppm), 0, ph	0	0	0	(0.1 ppm), 0, C	(1.0 ppm), 0	0 and seed, C, pp
Pumpkin	..	(25 ppm), 0, pp	0	..	0	(7 ppm), 0	..	0
Radish	..	..	..	..	0	..	..	0
Rhubarb (greenhouse)	..	(25 ppm), 0	..	..	..	(10 ppm), 0	..	..
Spinach	..	(100 ppm), 0, pp	..	..	..	7 and wash	..	10
Squash	(1 ppm), 0	(25 ppm), 0, pp	0	..	0	(7 ppm), 5	(4 ppm), 5	5
Sugar beet[d]	(0.2 ppm-roots, 15 ppm-tops), 21	0	..	..	..	10, B, C, 14, no feeding restrictions	(2 ppm-roots, 65 ppm-tops), B, 14	..
Swiss chard	..	0	..	..	..	..	..	10
Tomato	(5 ppm), 0	(25 ppm), 0, pp	0	0[g]	0	(4 ppm), 5, F	(4 ppm), 5	5
Turnip, rutabaga	..	(2 ppm), pp	..	..	..	10 and wash	..	(7 ppm), 7-tops
Watermelon	(1 ppm), 0	(25 ppm), 0, pp	0	0	0	5	(0 ppm edible parts), 5[e]	5

[a] No tolerances have been set for these fungicides on dill, horseradish, okra, parsley, and parsnip.
[b] The following abbreviations are used:
- A = Post-harvest application to ferns only or to young plantings that will not be harvested.
- B = Do not feed treated tops or forage to livestock.
- C = Do not use treated seed or seed pieces for feed or food.
- D = Do not apply to exposed bulbs.
- E = Do not apply after fruit buds form.
- F = To avoid damage, do not use on tender young plants.
- pb = Plant bed treatment.
- ph = Post-harvest spray or dip.
- pp = Preplant soil treatment.

[c] Mancozeb is sold as Dithane M-45 and Manzate 200.
[d] Tolerances are not needed for pesticides applied only to the foliage and not translocated to the tubers or roots.
[e] Number indicates number of days between last application and harvest; 0 = up to harvest.
[f] Do not apply if crop is to be used for processing.
[g] Machine harvest only.

LABEL INFORMATION ON FUNGICIDES OF LESS GENERAL USE

Fungicide (tolerance)	Crops and use restrictions
Botran	**Beans** (snap) — white mold, 2 days to harvest. Do not feed forage to livestock. **Greenhouse tomato** — to harvest. Do not drench seedlings or newly set transplants. **Carrot** — post-harvest dip or spray, see label. **Garlic, Onion** — soil application before seeding or spray to soil around sets or bulbs. *Do not plant spinach* as follow-up crop in treated soil. **Leaf lettuce** (greenhouse) — 14 days[a] (do not apply to wilted plants or seedlings). **Head lettuce** — 14 days. **Celery** — 7 days. **Cucumber** (greenhouse) — see label. **Rhubarb** (greenhouse) — 3 days. **Potato** — 14 days (do *not* feed to livestock). **Sweet potato** — root dip and plant bed treatment. Note: Do not plant tomatoes as followup in treated soil. Don't use spent roots for food or feed. Post-harvest spray or dip as directed.
Copper fungicides[b]	
tribasic copper sulfate (Kobasic, Triangle, Tri-basic Copper Sulfate, etc.)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, potato, pumpkin, radish, spinach, squash, tomato, watermelon.**
copper sulfate (many)	**Bean, broccoli, cabbage, cantaloupe, cassaba melon, cauliflower, celery, cucumber, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, watermelon.**
copper resinate (Citcop 4E, Cop-O-Cide, Emulsifiable Liquid Copper Fungicide)	**Bean, cantaloupe, cauliflower, chinese cabbage, cucumber, honeydew melon, lettuce, onion, pepper, pumpkin, squash, tomato, turnip, watermelon.**
copper ammonium carbonate (Copper-Count N)	**Bean, cabbage, carrot, crenshaw melon, celery, cantaloupe, cassaba melon, cucumber, honeydew melon, lettuce, muskmelon, pepper, Persian melon, potato, squash, tomato, watermelon.**
copper hydroxide (Kocide 101 and 404)	**Bean, cantaloupe, carrot, celery, cucumber, honeydew melon, muskmelon, pepper, potato, pumpkin, squash, tomato, watermelon.**
copper oxychloride sulfate (COCS, Copro 50 and 53)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cassaba melon, cauliflower, celery, crenshaw melon, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, Persian melon, potato, pumpkin, spinach, squash, tomato, watermelon.**
bordeaux mixture (Acme Bordeaux mixture, Pattersons Bordeaux mixture, Bor-Dox, Ortho Bordo mixture, etc.)	**Cress, cucumber, eggplant, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, turnip, watermelon.**
Dexon	Cleared *only* for seed-treatment us **beans, beets, corn, cucumbers, p spinach,** sugar beets. Do not use tre seed for food, feed, or oil. Slurry s treatment for planting in light soil soils high in clay or organic matte
dinocap (Karathane)	**Cantaloupe (muskmelon), cucum honeydew melon, pumpkin, squ watermelon** — 7 days. For control powdery mildew only.
etridiazole (Terrazole, Truban)	Seed treatment: **Beans, peas, sugar be**
polyethylene polymer (Polyram) (0 ppm)	**Potato, sugar beet** — no time lim tions. **Celery** — 14 days. **Cantalou cucumber, tomato** — 5 days. Do feed **sugar beet** tops to meat or d animals. **Celery** — strip, trim, and wa Post-harvest application to aspara ferns.
PCNB (Terraclor, Brassicol, Fungiclor) (0.1 ppm)	**Beans** — base of plants *before* blosso ing, soil and seed treatment at planti or foliar spray. Do *not* feed trea **Bean** vines to livestock. Do *not* ap after first bloom. **Broccoli, bruss sprouts, cabbage, cauliflower** — tra plant solution (¾ pint per plant) or r treatment before transplanting. **Pepp potato, tomato** — soil treatment at before planting. **Tomato** (field use on — transplant solution (½ pt. of 0. per plant). **Garlic** — soil and seed tre ment at planting.
streptomycin (0.25 ppm)	**Celery, pepper, tomato** — plant b only (200 ppm spray); **Potato** — se piece treatment only (100 ppm dip dust). Soak cut seed pieces less than min. **Beans** — seed treatment for h blight control. Do not use treated se for food or feed.
sulfur, lime, and lime-sulfur	Exempt when used with good agric tural practices. See label.
thiabendazole (Mertect)	**Sweet potato** — "seed" root treatme Do not use treated pieces for food feed. **Potato** — "seed" tubers only (1,5 ppm-20 sec. dip.
thiram, TMTD (0.5-7 ppm)	**Onion** — Furrow treatment. **Celery** 7 days (strip, trim, and wash). **Swe potato** — preplant root dip. **Tomato** 0 days, for leaf spots and fruit rots. Se treatment: **Beans, beets, broccoli, bru sels sprouts, cabbage, cantaloupe, ca rot, cauliflower, collard, corn, cucu ber, eggplant, endive, kale, kohlra lettuce, okra, onion** (bulb, seed, a set), **peas, pepper, pumpkin, radis spinach, squash, swiss chard, toma turnip, watermelon.** WARNING: I not use treated seed for food, feed, oil.
triphenyltin (Du-Ter)	**Potato** — early and late blight. May applied through irrigation systems (so set or center pivot only).

[a] Number of days between last application and harvest.
[b] There are many other copper materials, but these are most widely available and labeled for use on vegetable crops. Exempt from tolerance if used with go agricultural practices; not exempt if used at time of or after harvest. See label.

CONDENSED FUNGICIDE RECOMMENDATIONS FOR DISEASES OF COMMERCIAL VEGETABLE CROPS FOR 1979

Vegetable	Diseases	Fungicide[a]	Remarks
paragus	Rust (RPD934)[b], leaf and branchlet blights	zineb, maneb, mancozeb, or Polyram	Apply to non-harvested fields *throughout* season to August 15; to harvested fields *after* cutting only. Apply at 7- to 10-day intervals. May combine with insecticides to control asparagus beetles, cutworms, etc. (Cir. 897).[b] Polyram on ferns only.
	Root rots	mancozeb, captan	Use as a preplant dip.
ans (garden, wax, d lima)	Seed decay (RPD915), damping-off, and seed-borne stem blights and root rots	thiram, captan, Terrazole, or chloroneb plus insecticide	Treat seed any time if not previously treated by producer. Plant *only certified*, western-grown seed in warm soil above 65° F.
	Bacterial blights	fixed copper (2-3 lb. metallic/A.)	Apply at weekly intervals. Plant *only certified* western-grown seed.
	Rust, anthracnose, fungus leaf spots, pod and stem spots	maneb, zineb, or Bravo	Apply at 7- to 10-day intervals during moist weather. Combine with insecticides to control bean beetles, aphids, leafhoppers, blister beetles, etc. (Cir. 897).
	Mosaics		Use insecticides to control aphids (NHE-47)[b] that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Control weeds in and around fields (Cir. 907).
	White mold	Botran, PCNB, benomyl	Apply to base of plants just before bloom, or at 25-50% bloom (benomyl). Do not feed treated vines to livestock.
eets (garden and gar), oinach, wiss chard	Seed rot (RPD915), damping-off, and seed-borne leaf spot and anthracnose	thiram or captan	Treat seed any time or buy treated seed. To control damping-off apply captan (5-7 lb. of 50% WP in 25-30 gal. water/A. or 25-30 lb. of 10% dust/A.) in furrow at planting time.
	Cercospora leaf spot (RPD951), downy mildew	zineb or fixed copper (2-3 lb. metallic/A.)	Apply every 1 to 2 weeks during rainy periods. May combine with insecticides to control aphids, leafhoppers, caterpillars, leaf miners, etc. (Cir. 897).
	Mosaics, virus yellows		Use insecticides to control aphids (NHE-47) and plant bugs that transmit the viruses. Kill insects before they feed (Cir. 897).
occoli, ussels sprouts, auliflower, abbage, hinese cabbage, ollard, ustard, ale, ohlrabi, adish, utabaga	Seed rot (RPD915), damping-off, black rot (RPD924), blackleg (RPD955), radish black root (RPD948), Alternaria blight	hot water, then thiram or captan	Buy western-grown seed. Sow *only* seed treated with hot water. Control cabbage root maggots, cutworms, cabbage worms, etc. (Cir. 897). Four-year rotation with non-crucifer crops.
	Wirestem (*Rhizoctonia*) (RPD902), damping-off, seed rot (RPD916), Botrytis blight (RPD942)	PCNB-captan mixture	Dust or spray on soil just before, at, or after planting seed. Follow manufacturer's directions.
	Clubroot (RPD923)	PCNB 75	Apply in transplant water or starter solution, ¾ pt. per plant (about 400 to 600 gal./A.). Do *not* use emulsion form of PCNB.
	Downy mildew, leaf spots, white rust (RPD960), anthracnose, Botrytis blight (RPD942)	maneb, zineb, or Bravo	Apply at 5- to 7-day intervals (3-5 days for radish) in wet weather. Use maneb in seedbed(2 lb./100 gal.). Good coverage important. May need spreader-sticker. May combine with insecticides to control aphids, cabbage worms, etc. (Cir. 897).
	Mosaics, black ringspot		Use insecticides to control aphids (NHE-47) and cabbage worms (NHE-45) that transmit the viruses. Kill insects *before* they feed — especially in seedbeds (Cir. 897).
	Brittle root (primarily horseradish)		Use insecticides to control leafhoppers that transmit the virus (Cir. 897). Apply when leafhoppers are *first* noticed. Additional applications may be necessary if infestation is severe.
orseradish	Leaf spots	fixed copper	
arrot, arsnip	Seed rot (RPD915), damping-off	thiram or captan	Treat seed any time. May combine with insecticides.
	Aster yellows (RPD903)		Use insecticides to kill leafhoppers that transmit the mycoplasma, *before* they feed (Cir. 897). Begin when plants are 2-3 inches tall; apply weekly for 4 weeks. Control weeds in and around plantings (Cir. 907).
	Cercospora leaf spot, Alternaria leaf blight (RPD938)	captan, maneb, mancozeb, zineb, or Bravo	Apply at 5- to 10-day intervals in rainy periods. Thorough coverage essential. Start around June 15.

[a] Dosages: The quantity of material listed is the pounds of active (actual) ingredient to be applied to 1 acre unless stated otherwise (i.e., 3 lb./A.; 2 lb.)% WP; 20 lb. 5% dust). Abbreviations used: A = acre; WP = wettable powder; pt. = pint(s); gal. = gallon(s); T. = tablespoon(s) (level); sq. ft. = square ot or feet.

[b] RPD = Report on Plant Diseases; NHE = Natural History Entomology publication. General references: Circular 897, 1979 Insect Pest Management Guide - Commercial Vegetable Crops and Greenhouse Vegetables; and Circular 907, 1979 Herbicide Guide for Commercial Vegetable Growers. Materials available from ie County Cooperative Extension Service Offices.

CONDENSED FUNGICIDE RECOMMENDATIONS (continued)

Vegetable	Diseases	Fungicide	Remarks
Celery, Parsley	Seed rot (RPD915), damping-off, seed-borne blights	hot water, then thiram or captan	Treat seed just before planting or buy treated seed. If damping off starts, spray plants and soil 2 to 3 times, 5-7 days apart Use zineb (1 T./gal.). Three-year-old seed is free of late blight
	Leaf blights and leaf spots	maneb, zineb, benomyl, Dyrene, Bravo, mancozeb	Apply every 7-10 days in field except during very dry weather
	Mosaics, calico, ringspot		Use insecticides to control aphids (NHE-47) that transmit th viruses. Kill aphids *before* they feed (Cir. 897). Control weed in and around plantings (Cir. 907).
	Aster yellows (RPD903)		Use insecticides to control leafhoppers that transmit the myco plasma. Kill insects *before* they feed. Control weeds in and around plantings (Cir. 907).
Corn (sweet and pop)	Seed rot (RPD915), seedling blights, seed-borne root and stalk rots, leaf blights	Captan, zineb, Vitavax-thiram, or thiram *plus* insecticide	Treat seed any time or buy seed treated with both a fungicide and an insecticide (NHE-27).
	Bacterial wilt (RPD907)		Apply insecticides over row to control flea beetles (NHE-36) tha transmit the wilt bacteria (Cir. 897). One to 6 sprays may be needed, 3 to 5 days apart. Start the day *before* corn comes up
	Helminthosporium leaf blights	mancozeb, Polyram, or Bravo	Begin when disease first appears. Repeat at 7-day intervals or as required.
	Rust	zineb	Same as above.
Cucumber, Muskmelon (Cantaloupe), Pumpkin, Squash, Watermelon	Seed rot (RPD915), damping-off, angular and Alternaria leaf spots, Fusarium wilt, gummy stem blight or black rot, anthracnose, scab	captan, or thiram *plus* insecticide	Sow *only* certified, western-grown seed. Watering after planting with captan 50W (2 lb./100 gal. at 1 gal./125 sq. ft., every 5-7 days) controls damping-off. May combine with insecticides (Cir. 897) to control seed-corn maggots (NHE-27) in seedbed. Use 3- to 4-year rotation.
	Bacterial wilt (RPD905)		Use insecticides to control cucumber beetles (NHE-46) that transmit the causal bacteria. Kill beetles *before* they feed (Cir. 897). Applications needed from young seedlings to mature plants. Thorough coverage is essential.
	Anthracnose (RPD920), downy mildew (RPD927), scab (RPD928), blossom blight, leaf spots and blights (RPD918), fruit spots and rots, gummy stem blight or black rot	maneb, mancozeb, zineb, Bravo, Difolatan, Dyrene, or benomyl	Use captan or ziram (2-3 lb./100 gal.) on young plants. Apply at 7- to 10-day intervals from seedling emergence to vining. Start other materials *after* vines begin to run. Repeat at 5- to 10-day intervals to 7-10 days before harvest; keep new growth protected. May combine with insecticides to control cucumber beetles, aphids, vine borer, pickle worm, etc. (Cir. 897).
	Angular leaf spot (RPD919)	fixed copper (2-3 lb. metallic/A.) or soluble copper	Apply at 5- to 7-day intervals in warm, wet weather; or mix with zineb or maneb (2 lb./A.). Begin when plants start to vine or disease *first* appears.
	Mosaics (RPD926)		Use insecticides to control aphids (NHE-47) and beetles (NHE-46) that transmit the viruses (Cir. 897). Kill insects *before* they feed. Control weeds (Cir. 907).
	Powdery mildew (RPD925)	Karathane WD, benomyl (8 oz./100 gal.), Bravo *plus* spreader-sticker	Dust or spray. Thorough coverage essential. Repeat 5-10 days later. Do not apply within 7 days of harvest. Use benomyl alone.
Eggplant	Seed rot (RPD915), seed-borne anthracnose, Phomopsis blight (RPD949), and Verticillium wilt (RPD950)	hot water, then thiram or captan	Treat seed just before planting.
	Damping-off (RPD916)	captan	Seedbed or flat spray, 5 gal./100 sq. ft. Repeat at 5- to 7-day intervals.
	Blight (Phomopsis, Alternaria, Cercospora) (RPD949), anthracnose	maneb, zineb, or captan	Start when disease is first evident, *or* when first fruits are half mature. Repeat at 7- to 10-day intervals. *Do not use copper fungicides on eggplant.* May combine with insecticides (Cir. 897).
Lettuce, Endive	Seed rot (RPD915), damping-off (RPD916), gray mold (RPD942)	thiram, Botran, ferbam, zineb	Dust seed lightly with captan 75. Then apply Botran as dust or spray just before or just after seeding. For *field use only.*
	Aster yellows (RPD903), white heart		Use insecticides to control leafhoppers that transmit the mycoplasma. Kill leafhoppers *before* they feed (Cir. 897). Applications needed throughout season. Dust or spray weed borders.
	Mosaics (RPD946)		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Sow *only* mosaic-indexed seed. Control weeds in and around plant-growing areas (Cir. 907). Keep new and old beds as far apart as possible.

CONDENSED FUNGICIDE RECOMMENDATIONS (continued)

Vegetable	Diseases	Fungicide	Remarks
	Gray mold (RPD942), downy mildew, other fungus leaf spots, white rust	ferbam, maneb, or zineb	Apply at 5- to 7-day intervals in cool, damp weather. Do *not* apply within 10 days of harvest. May combine with insecticides to control aphids, leafhoppers, flea beetles, etc. (Cir. 897).
		Botran	Botrytis control. Do not apply within 14 days of harvest.
	Sclerotinia	Botran or ferbam	
·kra	Seed rot (RPD915), damping-off	thiram	Seed treatment. Apply any time.
·nion, ·arlic	Smut (RPD933), seed decay (RPD915), damping-off, seed-borne purple blotch	thiram or captan	Apply to seed any time (RPD933). For *onion sets*, use 1 lb. (100% active) to 20 lb. seed; for *bulb onions*, wet seed with Methocel sticker then treat with 8 lb. thiram 75 or captan 75 to 8 lb. seed. For *pickling and green bunching onions*, same as for bulb onions; but use half dosage. Control seed- and bulb-feeding insects (Cir. 897).
	Blast (RPD931), downy mildew, purple blotch, gray mold blight (RPD942), neck rot (RPD930)	maneb, Difolatan, Bravo 6F, Dyrene, mancozeb, or zineb *plus* spreader-sticker	Apply every 5 to 7 days in moist weather. May combine with insecticides to control thrips, onion maggots, cutworms, etc. (Cir. 897).
	Yellow dwarf, mosaics		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Keep new and old plantings *as far apart* as possible.
·ea, ·entil	Seed decay (RPD915), damping-off, seed-borne foot rots, Ascochyta and Mycosphaerella blights (RPD945), Fusarium wilts (RPD912), and bacterial blights	Dexon, thiram, captan, or zineb *plus* insecticide	Treat seed any time or buy seed treated with fungicide-insecticide. Sow certified, western-grown seed. Where captan or thiram are used, friction may reduce seeding rate; add graphite (1 oz./bu.).
	Leaf and stem spots or blights (RPD945)	zineb	Apply weekly in rainy weather where diseases have been severe in past.
	Mosaics (RPD947), streaks, stunt, mottle, wilt		Use insecticides to control aphids (NHE-47) and other insects that transmit the viruses. Kill insects *before* they feed (Cir. 897). Also treat field borders.
	Powdery mildew	lime-sulfur dust (4-6 ratio) 30 lb./A.	Do not apply at air temperature above 80° F. or when plants are in flower. Two applications, a week apart, when mildew *first* appears, should be sufficient.
·eanut	Seed rot (RPD915), seedling blights	Botran, thiram, Difolatan, or captan	Treat seed anytime. Do not use treated seed for food, feed, or oil.
·otato, Irish	Seed-piece decays (RPD915), and seed-borne Verticillium wilt (RPD950)	captan, maneb, Polyram, zineb, or mancozeb	Apply as dust or dip to cut and uncut tubers. Follow manufacturer's directions. Tubers should be well corked over. Plant in warm (over 50° F.) soil.
	Blackleg (RPD943)	streptomycin	May combine with treatment for seed-piece decays. Use uncut, B-size, certified seed.
	Early blight (RPD935), late blight (RPD936), and minor leaf spots and blights	maneb, mancozeb, Difolatan, Bravo, Polyram, Dyrene, Du-Ter	Apply at 4- to 10-day intervals. If rainy, shorten interval; if dry, lengthen. For "finish-up" sprays use fixed copper (3 lb. metallic/A.). May combine with insecticides (Cir. 897).
	Common scab (RPD909), and black scurf (*Rhizoctonia*)	PCNB(various formulations)	May help on *mineral* soils. Work into top 4-6 inches of soil at or before planting. Follow manufacturer's directions carefully. Dust seed pieces with difolatan or mancozeb.
	Mosaics, leafroll, mottle, purple-top, yellow dwarf, etc.		Use insecticides to control aphids (NHE-47), leafhoppers (NHE-22), etc., that transmit the viruses. Kill insects *before* they feed (Cir. 897).
·hubarb	Root and crown rots	fixed copper (3 lb. metallic/A.)	Drench crowns early in spring and after harvest. Plant *only* in *well-drained* soil.
	Leaf and stalk spots, anthracnose	captan, Botran	Avoid applications from 2 weeks before harvest until cutting is completed (greenhouse only). May combine with insecticides (Cir. 897).
	Mosaics, ringspots		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897).
·weet potato	Black rot (RPD953), foot rot (RPD958), Fusarium wilt (RPD954), scurf (RPD957)	Botran	Seed dip or bed spray.
		thiram (1½ oz./gal.), thiabendazole	Dip disease-free roots or sprouts just before planting. Follow manufacturer's directions. Seedbed disinfestation (Cir. 893). Three to 4-year rotation. Strict sanitation. Do not rinse after treatment.
	Storage rots (RPD952)	Botran (as post-harvest dip or in wash water)	Helps reduce transit and market losses caused by Rhizopus soft rot and black rot. Fumigate storage houses with formaldehyde.

CONDENSED FUNGICIDE RECOMMENDATIONS (concluded)

Vegetable	Diseases	Fungicide	Remarks
Tomato, Pepper	Seed decay (RPD915), seed-borne bacterial spot (RPD910), speck and canker (RPD962), early blight (RPD908), Septoria blight, anthracnose, Fusarium wilt (RPD929), leaf mold (RPD941)	hot water, then captan, or thiram	Treat seed, buy treated seed, or certified, disease-free transplan (Cir. 912).
	Bacterial spot (RPD910)	fixed copper-streptomycin mixture	Start when seedlings emerge and apply every 5 days. In *fiel* use fixed copper (2-3 lb. metallic/A.) plus maneb or mancoze (2 lb./A.).
	Damping-off (RPD916) and seedling blights, collar rot (RPD908)	captan, ferbam	Dust or spray in seedbed. Apply as plants emerge so spray rur down stems. Repeat every 4 to 7 days until 10 days befor transplanting. Follow the manufacturer's directions.
	Septoria blight (RPD908), early blight, anthracnose, late blight (RPD913) and buckeye rot, gray leaf spot, leaf mold (RPD941)	maneb, mancozeb, Polyram, zineb, Difolatan, Dyrene, Bravo benomyl	Apply every 7 to 10 days *after* first fruit clusters form. Five c more sprays may be necessary, depending on weather. Combin with insecticides to control flea beetles, climbing cutworm hornworms, fruit flies, etc. (Cir. 897). *Soil surface spray of mane or Difolatan after last cultivation improves anthracnose control.* Tomato leaf mold and Botrytis control.
	Mosaics (RPD917)		Use insecticides to control aphids (NHE-47) and beetles tha transmit the viruses. Kill insects *before* they feed (Cir. 897) Control weeds in and around plant-growing area (Cir. 907). Se out certified, virus-free transplants and start with virus-free seed
	Blossom-end rot (RPD906)	calcium nitrate (4-6 lb./A.)	Application of 4 or more consecutive sprays in the regular sched ule may reduce losses. Start when fruits are the size of grapes Irrigate to maintain uniform soil moisture.
	Cloudy spot (RPD914)		Use insecticides to control stink bugs that produce cloudy spo by feeding punctures (Cir. 897).
(General diseases that attack most vegetable crops)	Damping-off (RPD916) and seedlings blights; gray mold (RPD942) or Botrytis blight	After planting apply captan, thiram, or zineb (1 T./gal.); ferbam or ziram (2 T./gal.)	Disinfest seedbed soil (Cir. 893), then apply seed treatmen (RPD915). Then apply sprays or drenches after planting Apply *only* if damping-off appears in seedbed and when seedling need water. (*For crucifers, pepper, peas, beans, tomato, lettuce,* adc PCNB to other fungicides to give broad-spectrum control.) Us at least 5 gal. per 1,000 sq. ft. of bed. Repeat at 5- to 7-day intervals when temperature is below 75° F.
	Root knot and other nematodes; Fusarium wilts of various crops (RPD901,904,912,929, 954)	Heat or chemicals may be used. Consult Cir. 893 for names, general precautions, and directions	Disinfest seedbed soil (heat preferred, if available). Follow man ufacturer's directions exactly. Fumigants work best in light loose soils, free of trash, clods, and lumps. Avoid recontamina tion of treated soil. Best to apply fumigants during the fall that precedes planting. In general, soils must be at least 55° F. at the 6-inch depth with a time lapse of 21-28 days between treat ing and seeding. Some require gas-tight plastic covers.
	Root and stem or crown rots of various crops (RPD902,911,922,923, 932,948,953)		*Plant resistant varieties when available.*
	Verticillium wilt (RPD950)		

GENERAL SUGGESTIONS ON FUNGICIDE APPLICATION

1. Cover the foliage uniformly. *Ground equipment* — Apply 75 to 125 gallons per acre at approximately 400 pounds] square inch of pressure. Lower volumes and/or pressures may provide adequate coverage, but high-volume, high-pressure appli tions provide ideal coverage. Make sure the sprayer is functioning properly. Check the nozzles for cleanliness and wear. Boo height, accuracy of pressure gauge, agitation, and calibration should also be checked. *Aerial application* — Apply recommend amounts of pesticide per acre in 3 to 5 gallons of water. Make sure nozzles are properly aligned and clean, so uniform appli tion is achieved. Cover a swath no wider than is reasonable for the aircraft and boom being used. Spray only those fields whi are suitable for aerial application. Avoid fields of irregular shape or topography, particularly if they are bounded by power lin trees, or other obstructions.

2. Whenever possible spray when the air is still or when wind velocity is not excessive (less than 10 to 12 mph).

3. Avoid situations where pesticide drift may cause needless problems.

4. When it is compatible with the product label, use a spray adjuvant (surfactant). Some commonly available surfacta are: Colloidal Products X77 (liquid, non-ionic) spreader activator; Colloidal Products Multifilm L. (liquid); Colloidal Produ Spray Modifier (liquid, non-ionic) spreader sticker; Millers Nufilm 17 liquid spreader sticker; Millers Nufilm P liquid spread sticker; Allied Chemical Plyac (liquid) sticker; Rohm and Haas Triton B — 1956 (liquid, non-ionic) spreader sticker; Trit CS7, spreader-binder: and Du Pont Spreader Sticker (liquid) spreader sticker.

1979 Insect Pest Management Guide

COMMERCIAL VEGETABLE CROPS And GREENHOUSE VEGETABLES

You must be certified as a pesticide applicator to use restricted-use pesticides. See your county Extension adviser in agriculture for information.

ommercial vegetable gardeners find it impossible to pro-ce vegetables profitably unless they control insects at aximum efficiency and minimum cost. The housewife of day will not accept unsightly wormy vegetables; not only e wormy fruits and vegetables unappetizing but the aste from trimming increases food costs. Thus the com-ercial vegetable gardener must produce a quality product at is acceptable and safe to the consumer. Careful use the right insecticides will enable him to do this.

Insect pest management programs, which include the se selection of cultural, mechanical, biological, and emical methods, are suggested for the major insect pests vegetable crops and greenhouses. But, insecticides are ll the most efficient means of managing most insects.

This suggested insecticide guide has been prepared for e by Illinois commercial vegetable farmers; it is not for me gardeners, who should use only those insecticides at are extremely safe to handle, apply, and store. Fur-ermore, the commercial vegetable gardener must use a der variety of insecticides than the home gardener in der to obtain maximum insect control at the least cost.

In using insecticides, read the label and carefully follow e instructions. Do not exceed maximum rates suggested; serve carefully the interval between application and har-st, and apply only to crops for which use has been ap-oved. Make a record of the product used, the trade name, e percentage content of the insecticide, the dilution, the te of application per acre, and the dates of application.

Some of the insecticides suggested here can be poison-is to the applicator. In using them, the commercial grower expected to use precautions to protect himself, his work-s, and his family from undue or needless exposure.

In using this guide, always refer to the table on the next ge, which lists the limitations and restrictions on use. hese limitations apply to the vegetables as human food. you use any portion of a vegetable for livestock food ops, stalks, etc.) refer to the label for instructions as to e interval required between application and feeding.

The chemical names used in these tables may be un-familiar to you. These names are the common coined chemical names and as such are not capitalized. Trade names are capitalized. In the table of limitations the common names are listed first. If the trade name is more commonly used, it is listed in parentheses following the common name. Throughout the tables of suggestions, however, the common name is used if there is one. In case of question, refer to the table of limitations.

These suggestions are subject to change without notification during the growing season.

Requested label clearances for a few uses of insecticides, carriers, and solvents are uncertain for 1979, since many requests have not been officially cleared. Anticipating needed changes in labeling, we began modifying these suggested uses a few years ago. Be sure to check with your county Extension adviser if you are in doubt about the insecticide you plan to use. We will make announcements of label changes through the newsletters and news media to keep you up to date.

Insecticides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. A person wishing to use an insecticide classified for restricted use must be certified as a private or commercial pesticide applicator by the Illinois Department of Agriculture. Contact your county Extension adviser in agriculture for details on this program. Only a few insecticides have been classified at this time. More will be classified later. Insecticides bearing a restricted-use classification are identified by an asterisk (*) in this circular.

Suggestions for use of insecticides effective from a practical standpoint are based on available data. Soil textures, pH of the soil, rainfall, slope of the field, wind velocity at planting, method and accuracy of application, and other unpredictable factors affect efficiency.

This publication was prepared by entomologists of the University of Illinois College of Agriculture and the Illinois Natural History Survey.

NIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
cooperation with ILLINOIS NATURAL HISTORY SURVEY CIRCULAR 897 (revised annually) November, 1978

LIMITATIONS FOR FIELD VEGETABLES IN DAYS BETWEEN APPLICATION AND HARVEST AND OTHER RESTRICTIONS ON USE OF INSECTICIDES IN ILLINOIS

(Blank spaces indicate that the material is not suggested for the specific use in Illinois)

Insecticide	Beans	Peas	Broc-coli	Brussels sprouts	Cab-bage	Cauli-flower	Horse-radish[1]	Rad-ish[1]	Tur-nip[1]	Onions	Egg-plant	Pep-pers	Toma-toes
acephate (Orthene)	...	...	...	...	...	...	...	...	...	...	...	7	...
*azinphosmethyl (Guthion)[2]	...	...	15	7	21	15	...	...	...	...	...	...	...
Bacillus thuringiensis[3]	...	...	0	0	0	0	...	...	...	...	...	...	0
carbaryl (Sevin)	0	...	3	3	3	3	3	3	3, 14A	...	0	0	0
carbofuran (Furadan)	...	...	...	...	...	...	...	...	...	...	...	21B	...
Dasanit	...	...	...	...	...	...	...	...	...	C, D	...	...	...
*demeton (Systox)	...	...	...	...	...	...	...	...	...	...	...	3	...
diazinon	...	...	5	...	7	5	...	10	10	10	...	...	1
dicofol (Kelthane)	7E	...	...	...	...	...	...	...	...	...	2	2	2
dimethoate (Cygon)	0E	0E	7	...	3	7	...	...	14	...	...	0	7
Dyfonate	...	...	C	...	C	C	...	...	...	...	...	...	...
ethion	...	...	...	...	...	...	...	...	...	C	...	...	...
malathion	1	...	3	7	7	7	7	7	3	3	3	3	1
*methomyl (Lannate)	1	1, 5A	3	3	1	3	...	...	...	...	...	10	2
mevinphos (Phosdrin)[2]	...	...	1	3	1	3	...	...	3	...	...	...	...
Monitor	...	...	21	21	35	28	...	...	...	...	...	...	...
naled (Dibrom)	...	...	1	1	1	1	...	...	4	...	...	...	...
oxydemetonmethyl (Meta-Systox R)	...	...	...	...	...	...	...	...	...	...	7F	0B	...
*parathion[2]	7	...	7	7	10	7	...	15	10	...	15	15	10
phorate (Thimet)[2]	C	...	...	...	...	...	...	...	...	...	...	...	...
rotenone	...	...	...	...	...	...	...	...	...	...	1	1	1
trichlorfon (Dylox)	...	...	...	21	21	21	...	...	28E	...	...	21	21

Insecticide	Pota-toes[1]	Col-lards	Kale	Let-tuce	Spin-ach	Swiss chard	Sweet corn	Cucum-bers[4]	Mel-ons[4]	Pump-kins[4]	Squash[4] Winter	Squash[4] Summer
Bacillus thuringiensis[3]	...	0	0	0	0	...	...	...	...	...	...	...
carbaryl (Sevin)	0	14	14	14	14	14	0	0	0	0	0	0
diazinon	...	10	10	10	10	12	C	7	3	...	3	7
dicofol (Kelthane)	...	...	...	...	...	...	...	2	2	2	2	2
dimethoate (Cygon)	0	14	14	14	14	14	...	...	3	...	...	...
Dyfonate	...	...	...	...	...	...	C	...	...	...	...	...
malathion	0	7	7	14	7	7	5	1	1	3	1	1
*methomyl (Lannate)	6	...	...	10	7	...	0, 3A	3	3	...	...	3
*mevinphos (Phosdrin)[2]	...	3	3	2	4	...	...	...	...	...	...	...
Mocap	...	...	...	...	...	...	C	...	...	...	...	...
naled (Dibrom)	...	4	4	1	1	1	...	...	...	...	...	...
*parathion[2]	5	10	10	21	14	21	12	15	7	10	15	15
phorate (Thimet)[2]	C	...	...	...	...	...	C	...	...	...	...	...
rotenone	...	1	1	1	1	1	...	...	...	...	...	...
trichlorfon (Dylox)	...	28G	21	28G	...	...	...	...	...	3F	...	...

* Use restricted to certified applicators only.

[1] Root crops such as radishes. turnips, carrots, horseradish, potatoes, and sugar beets should not be grown in soil where aldrin, dieldrin, or heptachlor was applied as a soil insecticide the preceding year.

[2] Use only by professional applicators or commercial gardeners.

[3] Trade names are Bactur, Dipel, and Thuricide.

[4] Only apply insecticide late in the day after blossoms have closed to reduce bee kill.

A. If tops or stover are to be used as feed.
B. Not more than twice per season.
C. Soil applications at planting time only.
D. Do not use on green onion crop.
E. Do not use tops for feed or food.
F. Not more than three times per season.
G. Not after edible portions or heads begin to form.

REENTRY INTERVALS FOR WORKER PROTECTION

Insecticide	Hours
azinphosmethyl (Guthion)	24
demeton (Systox)	48
ethion	24
parathion	48

Workers must wear protective clothing if they enter treated fields before the time intervals shown at the right. They must also wear protective clothing for all other insecticides applied if the spray has not dried or the dust has not settled.

CABBAGE AND RELATED COLE CROPS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Cabbage maggot[1] (NHE-44)	All season	diazinon Dyfonate	3 2	Broadcast	Disk in just before planting. Use only for cabbage, cauliflower, and broccoli.
		diazinon granules	1	Furrow	At time of planting; on turnips a drenching spray of 1 lb. diazinon should be applied 30 days following treatment.
		*azinphosmethyl diazinon	3 oz. W.P. or 2 oz. E.C. per 50 gal. transplant water 4 oz. per 50 gal. transplant water		6 fluid oz. transplant water per plant.
Aphid (NHE-47) Thrips (NHE-48)	All season	*azinphosmethyl dimethoate malathion *mevinphos *parathion	¾ 0.3 1 ¼ 0.4	Foliage	When aphids appear, but before leaves begin to curl.
Diamond-back moth larva; imported cabbage worm; cabbage looper (NHE-45)	All season	*Bacillus thuringiensis* *methomyl Monitor	See rates on label 0.45-0.9 1	Foliage	When small worms first appear, and about every 5 to 7 days thereafter. Thorough spray coverage of foliage is important.
Cutworm	At planting	trichlorfon	1	Soil	At planting, at base of plant or as needed when damage first occurs.
Flea beetle and leafhopper	All season	carbaryl	1½	Foliage	As needed.

* Use restricted to certified applicators only.
[1] Maggots are resistant to diazinon in some areas of Illinois.
E.C. = emulsion concentrate; W.P. = wettable powder.

COLLARDS, KALE, LETTUCE, SPINACH, SWISS CHARD

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Aphid (NHE-47)	All season	diazinon dimethoate *mevinphos naled *parathion	½ 0.3 ¼ 1 0.4	Foliage	As needed.
Cutworm	On seedling plants	trichlorfon	1	Base of plant and soil	When first damage appears.
Leafhopper	All season	carbaryl dimethoate malathion	1½ 0.3 1	Foliage	When first leafhoppers appear and as needed.
Caterpillar (NHE-45)	All season	*Bacillus thuringiensis* methomyl[1] naled	See rates on label 0.45 1	Foliage	When small worms first appear and every 5 to 7 days thereafter.
Leaf miner	All season	diazinon dimethoate *parathion	½ 0.3 0.4	Foliage	When first miners are observed.
Flea beetle	All season	carbaryl rotenone	1 ¼	Foliage	As needed.

* Use restricted to certified applicators only.
[1] Use limited to lettuce and spinach only.

BEANS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Seed maggot (NHE-27)	All season	diazinon 50% W.P.[1] Lorsban 25% W.P.[1]	3/5 oz./bu. 2 oz./bu.	Seed Seed	Treat seed no longer than 3 months bef planting.
		phorate granules	1½	Soilband	Place on either or both sides of row t planting but not in contact with seed.
Bean leaf beetle (NHE-67)	Early and late season	carbaryl malathion	1 1	Foliage	When feeding first appears and wee for 2 or 3 applications as needed.
Leafhopper (NHE-22) and plant bug (NHE-68)	All season	carbaryl dimethoate malathion *methomyl	1 0.3 1 0.45	Foliage	Before plants become yellow and stunt. Repeat applications at weekly interv as necessary.
		phorate granules	1½	Soilband	As for seed maggot.
Mexican bean beetle	Midseason and late season	carbaryl malathion	½ 1	Foliage	When occasional leaves show lacew feeding.
		phorate granules	1½	Soilband	As for seed maggot.
Aphid (NHE-47)	All season	dimethoate malathion	0.3 1	Foliage	Usually applied when a few aphids can found on each plant, but before lea begin to curl and deform.
		phorate granules	1½	Soilband	As for seed maggot.
Blister beetle (NHE-72)	Midseason and late season	carbaryl	1½	Foliage	As needed.
Corn earworm (NHE-33) Corn borer	Late season	carbaryl *methomyl *parathion	1½ 0.45 ½	Foliage	As needed, but usually after Septeml 1. Worms may be present before bloo
Mites	Midseason and late season	dicofol dimethoate malathion	0.4 0.3 1	Foliage	As needed, but especially during drout periods particularly if carbaryl has be used on crops.
		phorate granules	1½	Soilband	As for seed maggot.

* Use restricted to certified applicators only.
[1] No restrictions when used as recommended.

CUCUMBERS AND OTHER VINE CROPS[1]

Insect	Time of attack	Insecticide[2]	Pounds of active ingredient per acre	Placement	Timing of application[1]
Striped and spotted cucumber beetles (NHE-46)	Seedling to mature plants	carbaryl *parathion	1 ½	Foliage	When beetles first appear; as often necessary thereafter.
Aphid (NHE-47)	All season	diazinon dimethoate[2] malathion *parathion	½ 0.3 1 ½	Foliage	When aphids become noticeable.
Squash bug (NHE-51)	All season	*parathion trichlorfon[3]	½ 1	Foliage	Do not apply until first eggs are fou hatching (about June 15 to July 15).
Leafhopper	July-August	malathion dimethoate[2]	1 0.3	Foliage	As needed.
Squash vine borer	June-September	carbaryl	1	Base of stem for 3 ft.	Weekly applications when vines begin run—usually 5 applications.
Pickle worm	August-September	carbaryl	1	Foliage	Weekly applications, beginning in la August.
Mites	July-September	dicofol malathion *parathion	½ 1 ½	Foliage	As needed.
Cutworm (NHE-77)	April-June	carbaryl	2	Base of plants	As needed.

* Use restricted to certified applicators only.
[1] Spray vine crops with insecticide only late in the day after blossoms have closed to reduce bee kill.
[2] Do not use dimethoate on cucumbers.
[3] Pumpkin is the only vine crop for which trichlorfon can be used for squash bug control.

TOMATOES AND EGGPLANT

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Cutworm (NHE-77)	Early and midseason	carbaryl trichlorfon	2 1	Base of plants or foliage	As needed.
Flea beetle	May-June	carbaryl rotenone	2 0.2-0.4	Foliage	Apply every week as long as needed.
Aphid (NHE-47)	May-July	diazinon dimethoate[1] malathion *parathion	¼ 0.3 1 0.4	Foliage	As needed, but before leaves curl.
Cabbage looper	July-September	*Bacillus thuringiensis* *methomyl	See rates on label 0.45-0.9	Foliage	When loopers are present.
Corn earworm Corn borer	July-September; occasionally in June	carbaryl *methomyl[1]	2 0.45-0.9	Foliage	Add to weekly applications of fungicide sprays beginning at first fruit set. If spraying is infrequent, use 6 lb. of toxaphene.
Hornworm	July-September	carbaryl trichlorfon	2 1	Foliage	When first small worms appear.
Mites	July-September	carbophenothion dicofol malathion *parathion	1 ½ 1 0.4	Foliage	As needed.
Russet mite	July-September	*parathion sulfur dust[2] sulfur spray[2]	0.4 10 10	Foliage	As needed.
Blister beetle (NHE-72)	June-September	carbaryl *parathion	1½ ¼	Foliage	As needed.
Fruit fly and picnic beetle	August-October	diazinon spray diazinon granules	½ 1	Foliage	When flies or beetles first appear.
		pyrethrin dust[2]	1	Foliage	Apply to hamper immediately after it is filled.

* Use restricted to certified applicators only.
[1] Use cleared only on tomatoes.
[2] No limitations on use.

PEPPERS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Aphid (NHE-47)	May-July	dimethoate demeton *methomyl oxydemetonmethyl acephate	0.3 ⅜ 0.45 ½ ½	Foliage	Only when aphids are present. Add to borer spray when it is being used.
Corn borer	Late season	carbaryl acephate	2 1	Foliage and fruit	When fruit is present on plant. Apply every 5 days when borers are present.
		carbofuran	2-3	Soilband to transplant	Make 2 applications; first, 3 weeks after transplant, second, 5 weeks later.

* Use restricted to certified applicators only.

ASPARAGUS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Asparagus beetle (NHE-49)	Early and mid-season on spears and ferns	carbaryl[1] malathion[1] rotenone[1]	1½ 1 0.2-0.4	Spears and ferns Spears	As needed, not more often than every 3 days. As needed.

[1] One-day restriction between last application and harvest.

SWEET CORN

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Soil insects (NHE-26, 27, 43)	April-August	diazinon Dyfonate Mocap phorate	1 1 1 1	Row	Apply on soil surface behind planter s and ahead of press wheel.
Cutworm (NHE-38)	April-June	carbaryl[1] carbaryl bait	2-3 1	Base of plants	When first damage appears.
Flea beetle (NHE-36)	April-July	carbaryl[1]	1½	Foliage	As necessary.
Japanese beetle (NHE-32)	July-September	carbaryl[1]	1	Ear zone	As necessary.
Corn borer	June-September	carbaryl[1] *methomyl	2 0.45	Foliage	Make first application when tassel r is 30 to 40. Repeat every 4 to 5 days long as field has 20 or more unhatc egg masses per 100 plants.
Corn earworm[2] (NHE-33)	June-September	carbaryl[1] *methomyl	2 0.45	Ear zone	Market corn: At first silk and every 2 3 days for 5 to 8 applications. On v early or late planted corn, treatment n be necessary before silking when eggs being laid on stalks and flag leaves. Canning corn: At 30 to 50% silk every 3 days thereafter until corn is wi in 8 to 12 days of harvest.
Sap beetle (NHE-10) Picnic beetle	July-September	carbaryl[1] diazinon malathion *parathion	2 1 1 ½	Foliage	When adults first appear in field; usu between pollen-shedding and silk-dryi
Corn leaf aphid (NHE-29)	July-September	malathion *parathion	1 ½	Foliage	As needed to produce attractive ears fresh market.
Fall armyworm	July-September	*methomyl *parathion	0.45 ½	Foliage	Apply to ear zone when whorl feedin evident.

* Use restricted to certified applicators only.
[1] During pollen shed, apply carbaryl as late in the day as possible (preferably after 4 p.m.) to reduce bee kill.
[2] Addition of 0.5 to 0.75 pound of parathion or 0.25 to 0.45 pound of methomyl to carbaryl improves earworm control.

ONIONS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Onion maggot (NHE-50)	All season	diazinon W.P. ethion W.P.	½-1 for 40-50 lb. of seed 1 for 40-50 lb. of seed	Seed	Seed treatment for set onions only. U lighter dosage of diazinon on sandy, hig mineral soils.
		Dasanit granules diazinon granules Dyfonate ethion granules	1 ½-1 1 ½-2	Furrow	Use 1 lb. active ingredient per acre rows 12″ apart; ¾ lb. for rows 18″ apa ½ lb. for rows 24″ apart. Up to tw these amounts are needed for ethion muck soils. Do not use Dasanit or Dyf ate on green onions.
		diazinon	2	Broadcast	Preplanting; disk into upper 1 to 2 incl of soil. Supplement with foliage spr below.
		diazinon malathion	⅓ 1	Foliage	Supplemental to soil treatment. Ma first application when first adult flies seen; make another 1 week later. Fr then on only as necessary.
Thrips (NHE-48)	Midseason and late season	diazinon malathion	½ 1	Foliage	When injury first appears and every days as necessary.

POTATOES

nsect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
lea beetle	May-July	carbaryl *methomyl	1 0.45	Foliage	When first damage appears on leaves, and repeat as needed.
olorado potato eetle	May-July	carbaryl	1	Foliage	As needed.
otato leafhopper (NHE-22)	May-July	carbaryl dimethoate *methomyl	1 0.3 0.45	Foliage	Weekly applications when leafhoppers first appear.
		phorate granules	2-3	Soilband	Place on either or both sides of row at planting but not in contact with seed. Use lower rate on sandy soils and heavier rate on heavy soils. Do not use on muck soils.
phid (NHE-47)	All season	dimethoate malathion *methomyl *parathion	0.3 1 0.45 ¼	Foliage	As needed.
		phorate granules	2-3	Soilband	As for leafhoppers.
lister beetle (NHE-72)	All season	carbaryl	1½	Foliage	As needed.
Vireworm (NHE-43) Vhite grub (NHE-23)	All season	phorate granules	2-3	Soil	Preplanting, disk in; or use as soilband at planting.
rasshopper (NHE-74)	July-September	carbaryl	¾	Foliage	As needed, control in fence rows, roadsides, ditch banks, etc., before migration.

* Use restricted to certified applicators only.

PEAS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Caterpillars including loopers	June	*methomyl	½-1	Foliage	Before harvest if worms are present.
Aphids	May-June	dimethoate	⅓	Foliage	As needed.

* Use restricted to certified applicators only.

Limitations for Greenhouse Tomatoes

Insecticide	Tomatoes
endosulfan (Thiodan)	15 hours
malathion	15 hours
metaldehyde	As bait applied only to soil
naled (Dibrom)	1 day
*parathion[1]	10 days

* Use restricted to certified applicators only.
[1] Do not use aerosols that contain parathion, tepp, or the propellant methyl chloride in greenhouses connected to living quarters.

GREENHOUSE TOMATOES

Insect	Insecticide[1]	Dosage and formulation	Application
Aphid Whitefly	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	naled vapor	5 oz. of 4% E.C. per 50,000 cu. ft.	Apply on steampipes.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
Mealybug Spider mite Russet mite Thrip		Use malathion or parathion aerosol as suggested for aphid and whitefly.	
Armyworm Cabbage looper Cutworm Tomato fruitworm	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
Slug	metaldehyde	Commercially prepared bait or spray	To mulch on soil surface. Do not contaminate edible parts.

* Use restricted to certified applicators only.
[1] See page 7 for limitations between application and harvest.

FOR ADDITONAL INFORMATION

Obtain the following circulars on insect control from the Office of Agricultural Publications, 123 Mumford Hall, Urbana, Illinois 61801.

Circular 899, 1979 Insect Pest Management Guide — Field and Forage Crops

Circular 900, 1979 Insect Pest Management Guide — Home, Yard, and Garden

Circular 1076, Turfgrass Pest Control

Leaflets describing the life history, biology, and habits of some of the insects mentioned can be obtained from the offices of county Extension advisers or by writing to Entomology Extension, 169 Natural Resources Building, Urbana, Illinois 61801. These are indicated by an NHE number in the tables.

FOR YOUR PROTECTION

Always handle insecticides with respect. The persons most likely to suffer ill effects from insecticides are the applicator and his family. Accidents and careless, needless overexposure can be avoided. Here are a few easy rules that if followed will prevent most insecticide accidents:

1. Wear rubber gloves when handling insecticide concentrates.
2. Do not smoke while handling or using insecticides.
3. Keep your face turned to one side when opening insecticide containers.
4. Leave unused insecticides in their original containers with the labels on them.
5. Store insecticides out of reach of children, irresponsible persons, or animals; store preferably in a locked cabinet.
6. Triple-rinse and bury or burn all empty insecticide containers or take to an approved sanitary landfill.
7. Do not put the water-supply hose directly into the spray tank.
8. Do not blow out clogged nozzles or spray lines with your mouth.
9. Wash with soap and water exposed parts of body and clothes contaminated with insecticide.
10. Do not leave puddles of spray on impervious surfaces.
11. Do not apply to fish-bearing or other water supplies.
12. Do not apply insecticides, except in an emergency, to areas with abundant wildlife or to blossoming crops visited by bees. Avoid drift onto blossoming crops or onto bee hives.
13. Do not apply insecticides near dug wells or cisterns.
14. Do not spray when weather conditions favor drift.
15. Observe all precautions listed on the label.
16. To avoid bee kill, apply insecticides after bee activity has been completed for the day; use the least toxic materials. *Warn beekeepers that you are applying insecticides.*

Proceedings

1980 Illinois Vegetable Growers Schools with research reports and grower suggestions

University of Illinois at Urbana-Champaign
Agricultural Experiment Station
Cooperative Extension Service, College of Agriculture

January 1980
Horticulture Series 18

FOREWORD

> *"Let us never forget that the cultivation of the earth is the most important labor of man. When tillage begins, other arts follow. The farmers, therefore, are the founders of civilization."*
>
> Daniel Webster

Illinois is a national leader in all aspects of agricultural production. Changes in demographics of our population, the economy, and inflation impact on the commercial producer. The development (research) and application (extension teaching) of new technology is crucial. The "Food for Century III" program holds much promise to improve the future of Illinois' agriculture. Horticulture and related programs at Urbana-Champaign and at Dixon Springs in Southern Illinois are essential ingredients in the FY 1981 food production research budget.

STATUS OF FOOD PRODUCTION RESEARCH PROGRAM--FOOD FOR CENTURY III[1]

"The Food for Century III Program at the University of Illinois was initiated as a joint response of the University of Illinois and State of Illinois to the growing worldwide need for increased food production. Illinois has long been among the leading states in agricultural production, due in part to the special strengths in research and extension at the University of Illinois. A program to continue the development of those strengths will help Illinois maintain its leadership role, while providing new efforts toward greater agricultural productivity.

"The goal of the Food for Century III Program is to expand and enhance the capabilities of the Colleges of Agriculture and Veterinary Medicine by providing adequate physical facilities for research and extension activities. The University possesses the human resources to increase these activities, and the State has agreed that expansion and improvement of physical resources is an investment which should be made. The Food for Century III Program thus contains a series of new building construction, remodeling, land acquisition, and equipment projects to be implemented over a multi-year period.

"Food for Century III was proposed in Fiscal Year 1978, and it was met with enthusiastic support from the General Assembly and the Governor. An initial appropriation of $2,763,425 in FY 1978 provided funds for formal planning activities to begin on the Veterinary Medicine Basic Sciences Building and the Agricultural Engineering Sciences Building, two relatively small construction projects, and two land acquisition projects. A significant appropriation of $28,715,700 followed in FY 1979. This amount included funds for the construction of the Veterinary Medicine Basic Sciences Building ($21,027,800) and the Agricultural Engineering Sciences Building ($7,612,900). These two buildings will meet the campus' most pressing and immediate needs for improved research facilities.

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[1] *Prepared by Office for Planning and Budgeting, University of Illinois.*

"FY 1980 has brought continuing support for the concepts which underlie the Food for Century III Program and additional funds to continue its implementation, though at a reduced pace. The General Assembly approved projects totaling $5,695,400. This amount was to provide funds to remodel the Meat Science Laboratory, to construct three small veterinary research buildings, to construct a Swine Research Center, to plan for the construction of greenhouses and headhouse, to purchase experimental land, to construct facilities for a veterinary research farm, and to provide land and construction for the Western Illinois Agriculture Center.

"While reiterating his overall support for the Food for Century III Program, the Governor did not approve the full amount passed by the General Assembly for FY 1980 (Table 1). The first three projects passed by the General Assembly received approval, as did the Western Illinois Agriculture Center. Unfortunately, the planning for the greenhouse and headhouse replacement projects, the experimental land, and the veterinary medicine research farm components were vetoed.

TABLE 1. FOOD FOR CENTURY III FUNDING - FY 1980

FY 1980 projects	Passed by the General Assembly ($)	Approved by the Governor ($)
Western Illinois Agriculture Center (land and construction)	503,100	503,100
Meat Science Laboratory Remodeling	1,026,000	1,026,000
Veterinary Medicine Research Buildings (construction and equipment)	1,057,500	1,057,500
Greenhouse Replacement Planning	186,600	0
Swine Research Center Construction	1,742,400	1,742,400
Swine Research Center Equipment	50,000	0
Greenhouse Headhouse Planning	104,300	0
Veterinary Medicine and Agricultural Research Land	720,000	0
Veterinary Research Farm Complex Construction	305,500	0
Total FY 1980	5,695,400	4,329,000

"The slowing of the pace for implementation of Food for Century III in FY 1980 places special emphasis upon the FY 1981 request. Although the highest priority projects for FY 1980 were approved, exclusion of the greenhouse and headhouse planning delays that project while intensifying its need, as outmoded and sorely inadequate facilities must serve for at least a year longer. In addition, for some projects delay means increased prices, due to escalation in construction costs.

"Similarly, the need for additional experimental land and the additional construction for the veterinary research farm complex remains high. At the same time, the need for projects programmed for FY 1981 must be met. Equipment for projects already funded and under construction -- Veterinary Medicine Basic Sciences Building, Agricultural Engineering Sciences Building, Swine Research Center -- must be provided in FY 1981 to make these facilities useful when construction is completed. Planning for the Isolation Research Laboratory must begin next year if the project is to be completed as programmed and available for new research efforts.

"The full request for FY 1981 appears in Table 2. The total amount sought -- $4,607,300 -- is not large, even in comparison to FY 1980, or to FY 1978. The 1981 request is of major significance, however, in that planning funds are sought for two major projects to be constructed the following year. In this respect, FY 1981 is quite similar to FY 1978. Funding of the full FY 1981 request will provide an excellent opportunity for the General Assembly, the Governor, and others concerned with the continued strengthening of agricultural production in Illinois to reaffirm their commitment to the research and extension efforts which form the basis of past successes and the potential for future improvements."

TABLE 2. FOOD PRODUCTION RESEARCH PRIORITY LIST - FY 1981

Priority	Project	Budget category	Amount	Cumulative total
			($)	($)
1	Ag. Engr. Sciences Building	EQUP	340,000	340,000
2	Vet. Med. Basic Sciences Building	EQUP	560,000	900,000
3	Swine Research Center	EQUP	185,000	1,085,000
4	Greenhouse Replacement & Headhouse	PLAN	441,400	1,526,400
5	Isolation Research Laboratory	PLAN	591,300	2,117,700
6	Agriculture - Vet. Medicine Land	LAND	720,000	2,837,700
7	Vet. Research Farm Complex	BLDG	443,900	3,281,600
8	Dixon Springs Land	LAND	600,000	3,881,600
9	Dixon Springs Research Facility	BLDG	725,700	4,607,300

Research and extension staff in several departments of the College of Agriculture, the Natural History Survey, and the Water Survey contributed to this Proceedings. It records information presented at 1980 Illinois Vegetable Schools, research reports, and extension recommendations for vegetable growers. The update reports along with current recommendations for insect, disease, and weed control, make this booklet a valuable reference manual for year-round use by all market growers throughout Illinois. Additional copies are available at a cost of $3 each. Make checks payable to the University of Illinois and send your order to the Department of Horticulture, 124 Mumford Hall, Urbana, IL 61801.

Thanks and appreciation are due the commercial seed companies, agricultural chemical manufacturers and suppliers, the Illinois Vegetable Growers Association, and commercial growers who support and participate in our extension and research programs.

J. W. Courter
Professor of Horticulture
and Editor of Proceedings

URBANA, ILLINOIS JANUARY, 1980
Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914 in cooperation with the U. S. Department of Agriculture. John B. Claar, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign.

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WEATHER AND CLIMATE FORECASTING AND CONTROL

*Stanley A. Changnon, Jr.**

Introduction

When one speaks of either forecasting or control of weather or climate, the key question is, "Is there any hope for improvements in capabilities to do either?" The two areas of greatest public interest and interaction with weather, concern its forecasting and ways to ameliorate its extremes through modification.

Since the Illinois vegetable growers are very sensitive to weather and its day-to-day and year-to-year fluctuations (climate), it seems appropriate for me to take a scientific perspective on forecasting and modification and to assess for you the status of forecasting and modification. I would also speculate on the future time frame for major improvements to occur. Much weather and climate research is focusing on improvements in forecasting and modification.

It is important to realize that the modern era of meteorology began in WWII and hence is only slightly longer than 30 years. There were less than 100 research meteorologists and climatologists in this country prior to 1941, but now there are more than 5,000. We are dealing with the atmosphere which is an extremely complex, 3-dimensional fluid enveloping the globe. This blanket of air contains a great number of variables, all constantly changing, that must be monitored, recorded, digested, and interpreted, only to have a new set of millions of values to consider within minutes. Another very complicating problem limiting advancing our knowledge of weather prediction and control relates to the lack of these values over the oceans. Eighty percent of the earth is covered with water and we have very few weather measurements over this surface.

So, I ask you to understand and to bear with us while we grapple with one of the most complicated sciences and one which is still in its infancy. We have been aided greatly by the advent of computers which can store the enormous data banks we need. Satellites are beginning to help us survey the weather of the oceans. Furthermore, meteorology and climatology are in a rapid part of their learning curves and better products should occur soon. Thus, I can say with certainty, improvements are coming. You as a user of information must stay with us and have patience.

An important concept to appreciate is that forecasting of the weather and its modification are intimately tied together. Obviously, to be successful they both require thorough understanding of the atmosphere, something we are striving to get. But, one cannot wisely modify the weather without a reasonably good long-range forecast. For example, in Illinois, the decision to seed clouds to add water in July and August, a decision that is made on 1 July, needs a good estimate of what the likely July and August rainfalls will be. If cloud seeding

**Head, Atmospheric Sciences Section, Illinois State Water Survey, Box 232, Urbana, IL 61801*

works and adds 25% more rainfall, it seems good, but it is not a good choice if nature ends up producing 8 inches or more of rainfall in July.

I would like to briefly address four topical areas: 1) weather forecasting; 2) climate forecasting; 3) weather modification; and 4) unintended weather and climate modification. In each of these challenging subject areas, I will describe the current status of our knowledge and capability, and how long it will take for much-improved skills to be developed. The Water Survey has research projects dealing with forecasting the weather and the climate, and others concerning planned and unintended weather modification.

Weather Forecasting

Major changes relating to the approach towards weather forecasting have been occurring in the last 20 years. Our ability to manage large weather data banks in computers and better knowledge of the upper atmosphere have shifted the forecast approach (used by the National Weather Service) from individuals doing their own analysis in many locales around the nation to use of one computer at the National Forecast Center to produce the forecast. This change has brought a variety of improvements and a simultaneous loss of individual skills. We have noted steady and sizeable improvement in the forecast of winds and temperatures, which are seldom off by more than 2° or 3°F. One now typically receives a range of forecasted low temperatures which are designed to handle the range expected over an area (for which the forecast is being made). This range incorporates temperature differences apt to be found in towns, cities, river valleys, etc. It is very important to realize that the forecast that we receive over our radios and televisions are designed for a large region like Central Illinois. Hence, it is offered either with a range of wind temperature values and the precipitation in probabilities to allow for usual interregional differences.

It is also important to appreciate that the majority of Americans typically are not directly affected by the exactness of the weather forecast. Most urban-dwellers live in a modified environment and are seldom directly affected by the weather other than infrequently as it affects their leisure time and transportation. A highly accurate weather forecast is just not needed for most people, and many do not realize that highly skilled forecasts can be produced if one is willing to pay. The National Weather Service function for weather forecasting is often too general for those who are very weather sensitive. My advice to a group or industry that is very weather sensitive is to purchase special forecasting services available from private firms. Several industries like airlines even have their own forecasting groups to serve their specialized needs. Very skilled and timely weather forecasts can be obtained for weather-sensitive interests. Costs are not terribly high and this option should be considered by a weather-sensitive industry.

A prime concern of many scientists has been the lack of progress in precipitation forecasting. As measured in percentages, the improvement has been, let us say, from 70 to 80 percent over the last 15 years. I serve on a National Academy of Sciences Panel which is attempting to assess the precipitation forecasting situation and to point to those activities that need to be pursued to obrain greater precipitation forecast skills. Basically, much more scientific attention will have to be given to the problem to obtain major breakthroughs. Regardless, I do not feel that major improvements in rain forecasting will occur in the next 10 to 15 years. Here, I am talking about highly skilled, quantitative rainfall or snow forecasts for your specific locale for tomorrow, the next day, and next week to 2 weeks.

The Water Survey has been involved in an interesting rain forecasting demonstration program for the last few months involving our weather radar and highly skilled meteorologists. This project reveals how a set of specialized users of highly accurate short-term rain forecasts can be served. We have been predicting the amount of rainfall over various parts of the Chicago metropolitan area on scales of 30 minutes up to 6 hours to enable better management of the complex storms and sewer drainage systems of the city. We have had excellent success, particularly in predicting the time and amounts of the moderate to heavy rainfalls which they are concerned with. It gives me great pleasure to observe that skilled meteorologists with high-quality equipment (radar and satellite) can produce highly skilled short-term rainfall forecasts for an area *if the user wants to pay for it!*

Climate Prediction

In the last few years, as our nation has rapidly become much more sensitive to weather because of energy and water use problems, there has suddenly become a great interest in developing a capability to forecast climate. In the last four years the National Weather Service has begun to offer seasonal "outlooks" because of the great pressure deriving from the initial energy crisis of 1974. As you are aware, there are many important agricultural decisions of the individual, the elevator operator, the shipper, the food processor, and to the nation which need or could benefit from forecasts of the climate many months ahead. For example, what would you do today if you knew, with a high degree of certainty, what the spring or summer weather of 1980 was going to be? What decisions in purchasing seed types, in buying equipment and supplies, and in making investments could be made better? Obviously, climate forecasts are important to agriculture, energy, and water resources.

Basically, our skills to make climate forecasts is very limited. They too are very difficult for the same reasons that weather forecasts are, and until recent years practically no one has been working on these. National concern has led to the National Climate Program Act which calls for great climate efforts to get us past the coin toss (50-50) skill level.

Our organization, however, is one of five in the nation that has been performing major research projects to attempt to sharpen skills or to obtain "breakthroughs" in the area of climate forecasting. Much of the ongoing work is based on study of climatological statistics, not on a thorough understanding of how the atmosphere will function many months and years ahead. The number crunching approach is now possible since we now possess good weather statistics for the past 80 to 100 years and we have computers to rapidly process these data. There is no great hope, in my opinion, of having physically based, climate forecasts in the next 20 years. However, there is hope of developing improved statistically-oriented climate forecasts. For example, the Water Survey's statistical "analogy" approach is being tested using precipitation and temperature

ILLINOIS

Table 1. Comparison of Yearly Predicted Trends with Actual Trends for 1973 through 1975 Using Seasonal Precipitation Input for 1931-1972.

Districts	1973	1974	1975	% Correct
	Trends, Up (U) or Down (D) with Predicted on the Left and Actual on the Right for Each Year			
1(NW)	D/D	U/D	U/D	33
2(NC)	D/D	U/U	D/D	100
3(NE)	U/U	D/D	U/D	67
4(WC)	U/U	D/D	D/D	100
5(C)	D/D	U/D	D/D	67
6(EC)	U/U	U/D	U/D	33
7(SW)	U/U	D/U	D/D	67
8(SC)	U/U	D/D	U/U	100
9(SE)	U/U	D/D	D/U	67
Percent Correct	100	56	56	70

seasonal values for crop reporting districts in the Midwest. We are first attempting to predict whether the seasonal and annual values will be up or down trends from current values. That is, will next summer be wetter or drier than this summer? Table 1 presents the results for the prediction of annual precipitation trends in Illinois for the nine crop reporting districts in Illinois using our rather complex technique. It shows that the trend predictions for the first year were totally correct in all nine districts, 100% accuracy. However, in the second and third years our predictions were only slightly better than 50%, or chance. Nevertheless, high skill for one year ahead is, we believe, highly useful and a successful outcome.

There is now similar research of largely a statistical nature elsewhere, and I believe that within the next 5 years we will have statistical predictions that many will find useful. That is, someone will be able to tell you by 1985 that there is a 90% chance that next summer will be a wet one.

Weather Modification

Planned weather modification which includes efforts to increase rainfall, to add snowfall, and to decrease hail, is a technology in its infancy. There has been some proof that weather, under certain conditions and in a few locales in the U.S. has been modified. Certain types of fogs are routinely removed at airports, and there appears to be good evidence that snow can be enhanced in certain mountainous areas in the Midwest. There is less certainty of success in the increase of summer rainfall through the seeding of clouds. Use, largely by farmers, and scientific experimentation has been on-going for 25 years and progress has been slow for several reasons, but basically because we know too little about the atmosphere.

Illinois farmers in the last four summers have been willing to pay cloud seeders to come and attempt to get increases in summer rainfall. In the face of the great uncertainty over cloud seeding success, the potential pay offs of added rainfall in July and August were sufficiently high to encourage sponsors to risk their capital. The cost to the individual is extremely low, typically 10¢ to 50¢ per harvested acre. The Water Survey has worked with the local sponsors and the College of Agriculture, to collect data to evaluate the results of some of the cloud seeding projects. Although the analyses have been limited, there appears to be a mixture of weak indications of added rain in one year, and decreased in another. The changes in either case are small and not beyond the normal statistical variations in summer rainfall in Illinois.

The Water Survey has been a national leader in studies of planned weather modification. Our approach to planned weather modification has focused on answering the dual questions: "Can it be done, and should it be done?"

A critical aspect of the issue facing Illinois, and all the Midwest, is lack of experimentation to discern whether the weather can be modified at a useful level. Most experimentation in weather modification has been conducted in the Great Plains and the Rockies where capabilities to change the weather have been only partially demonstrated. We also know that the modifiable clouds of the

Great Plains are not like those in Illinois. The findings elsewhere cannot be transferred here, and there is only one answer for planned weather modification in the Midwest: *experimentation in the atmosphere*.

To this end, Survey scientists have devoted considerable attention to the design of experiments to either increase summer rainfall or to suppress hail.

A major 8-year project to develop the design of a hail suppression experiment in Illinois, funded largely by the National Science Foundation, has been done. Illinois is now ready to launch such a well-designed hail experiment, should it be desired.

The Water Survey also began a program in 1971 to evolve the design of an experiment to investigate rain modification. These research efforts were funded initially by the National Science Foundation and by the Department of the Interior. The potential social, legal, economic, and environmental impacts have been a part of our research.

The Illinois State Water Survey and the Agriculture Experiment Stations at Illinois, Purdue, Michigan State, and Ohio State are now conducting the first phase of a major experiment to determine whether there is any real feasibility of cloud seeding to increase summer rainfall. Our major experiment is called Precipitation Augmentation for Crops Experiment, or PACE. It is just beginning to expand with a combination of federal (NOAA) and state funding in 1979. We will be using a host of sophisticated weather equipment including radars, raingages, and aircraft in 1980 to penetrate and then study Illinois clouds to see whether they have the potential for successful modification in critical crop growing times. If we find a sufficient number of potentially suitable clouds in our studies over the next 2-3 years, we will do seeding experiments to see how well seeding works. PACE will likely extend into the late 1980's.

I stress that weather modification deals with extremely complex atmospheric behavior and that predictable modification is far from being established in the Midwest. Careful experimentation, with meteorologists, agriculturalists, and water resource people working hand-in-hand is the only way to proceed to answer the two questions of can we and should we change the weather.

Unintended Weather and Climate Modification

Interestingly, most everyone in Illinois is living in a climate that is modified from its natural state.

- 70% of us live in communities of over 10,000 population and these urban areas have warmer, slightly drier, and less windy climates than those in the surrounding rural areas.
- The rural and suburban dwellers of St. Clair and Madison Counties (east of St. Louis) and in Cook County have cloudier, wetter, and stormier weather than do others.

Rural and urban citizens of Illinois have a summer and fall climate where the temperatures are modified slightly by the added cloud cover produced by high-level jets crossing the state.

For many years, farmers have practiced microscale weather and climate change by planting windbreaks and using smudge pots in their orchards. Some would even claim that umbrellas are a way to modify the weather. However, much of what we have been able to establish as proof of weather and climate modification has come from man's unintended land use changes.

Water Survey scientists and others have just finished major studies showing that large cities, such as St. Louis and Chicago, make major modifications to their weather, including added clouds, rainfall, and storms over and well beyond the city. I am sure that some of you have seen clouds growing out of the effluents of large industries and power plants. The St. Louis related changes in weather occurring in Illinois in the summer are shown on Fig. 1. These changes both hurt some and help others, being generally helpful to cash grain farmers and generally harmful to suburban dwellers because of additional flooding.

Another commonly observed form of weather modification are the lacy cirrus clouds being produced by the hundreds of high flying contrail jets zooming over Illinois each day. Our studies show that 3600 square mile areas in central and northern Illinois have between 400 and 700 jet flights over them each day, not to mention military and private jets. Under certain weather conditions these leave persistent contrails which become a part of our cloud climate. Figure 2 shows the changes in cloudy skies and sunshine that have occurred at Peoria and St. Louis in recent years. We are now having the cloudiest weather since records began in 1890. Part of this change, particularly over the past 15 years, is attributable to the jet-induced cloud cover. Water Survey studies show that this additional cloudiness has brought a moderation of monthly temperatures with many more months in summer and fall having less extreme high and low temperatures than in prior years. That, in itself, is not all bad.

Summary

One of the important messages from the study of unintended weather and climate changes is that we know more about this than we do about planned weather modification. We can predict the placement and type of changes that power plants and cities produce and we know how these changes occur.

The question "Can we modify the weather?" has been partly answered by findings that reveal the presence of unintended weather and climate modification throughout most of Illinois. Clearly, large Midwestern cities modify the weather in a significant way, including our clouds and precipitation. However, we still need experimentation to answer the questions of when, where, and how we can purposefully alter rainfall or hail.

We also know that weather and climate changes produce winners and losers. The question of "Should we modify the weather?" has also been partially answered

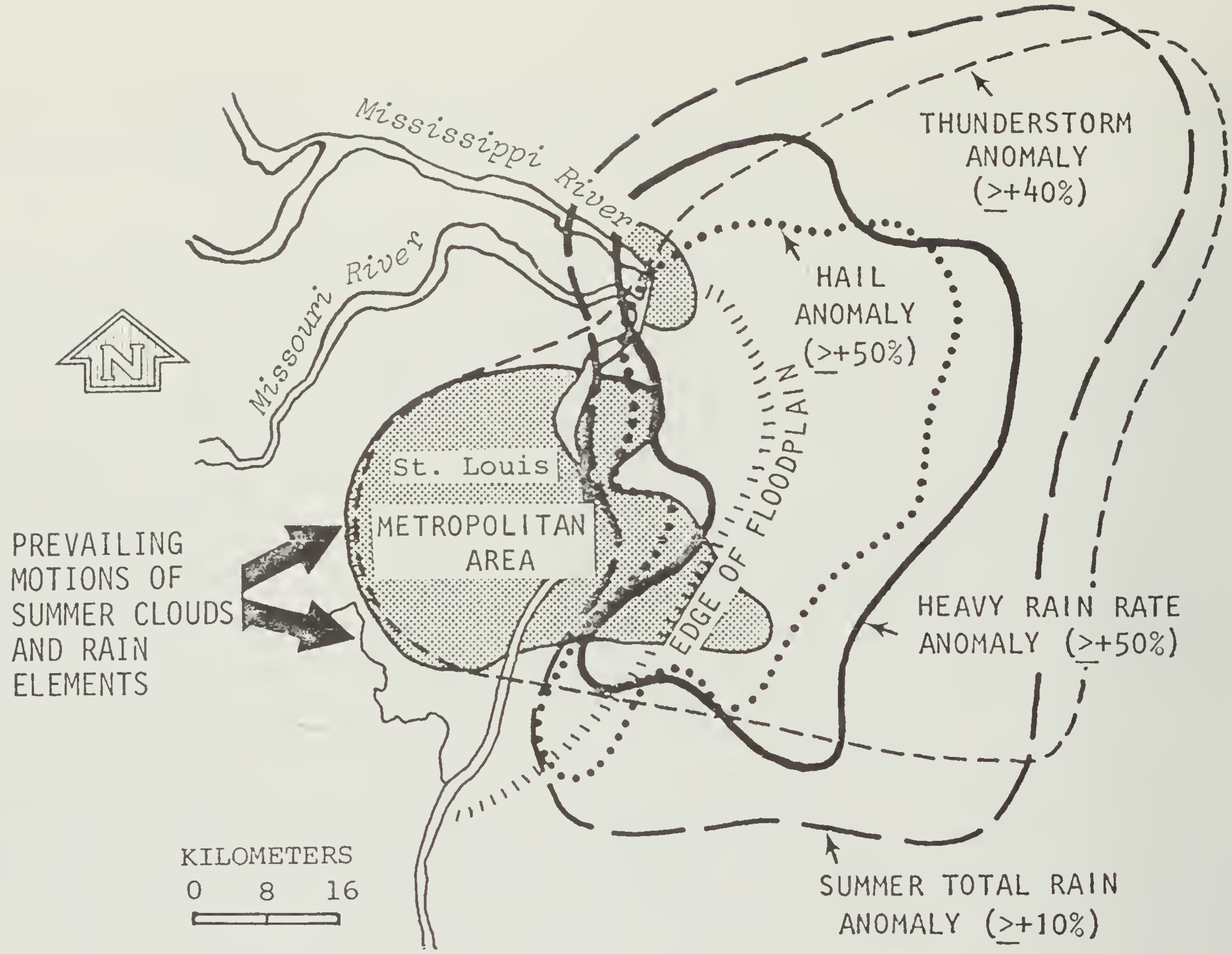

Figure 1. The local anomalies found in summer rain and severe storms.

by study of inadvertent weather changes and their economic and environmental impacts. Rain modification appears to have an advantage to Illinois agriculture. However, studies of public attitudes, environmental impacts, and economic aspects must be pursued in the future experiments like PACE which will answer the two key questions, "Can it be done in Illinois?" and "Should it be done?"

Good short term weather forecasting is available now for those who wish to pay for special services. Good longer range, 1 to 14-day rain forecasts are many years away. Statistically-based climate forecasts will be achieving useful levels of accuracy in the next 5 years. The complexity of the atmosphere is slowly being revealed.

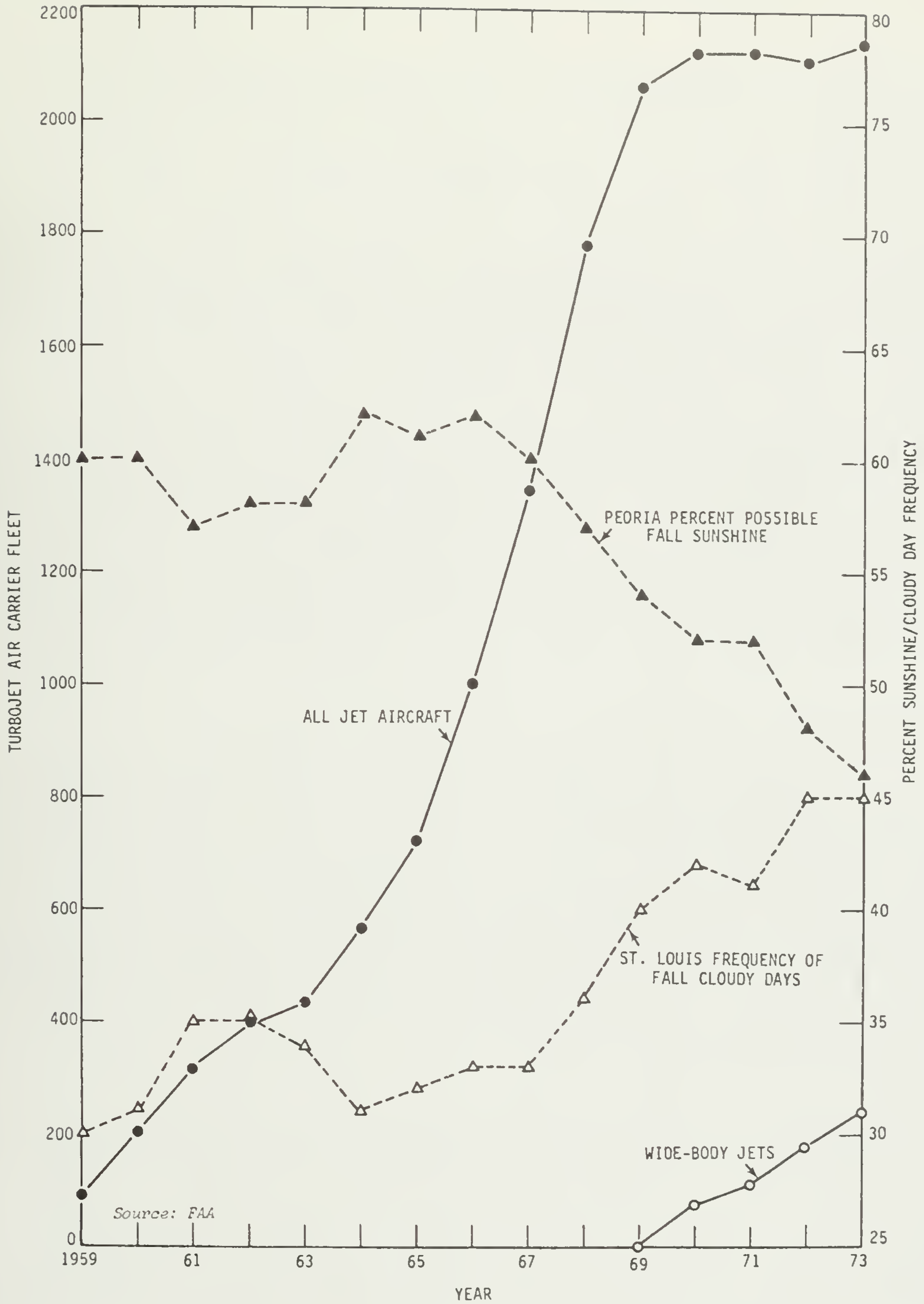

Figure 2. The temporal growth of the national commercial jet aircraft fleet including the introduction of wide-body equipment for the period 1959-1973. Fall season data for the percent of possible sunshine at Peoria, Illinois and the frequency of cloudy days at St. Louis, Missouri are also shown.

NEW DEVELOPMENTS IN MECHANICAL HARVESTING AND POTENTIALS FOR FRESH MARKET VEGETABLES

G. K. Brown

Total commercial acreage of fresh market vegetables in the U.S. and in Illinois gradually decreased between 1960 and 1977 (13). Illinois lost 9,000 acres with 7,500 of that since 1972. Similar trends occurred in Indiana and Ohio, but fresh market vegetable acreage in Michigan increased significantly since 1971.

During this same period 1960-77, the U. S. population continued its steady increase and the volume of fresh vegetables consumed increased but at a slower rate. The per capita consumption of fresh vegetables was about 6% less in 1977 than in 1960, but has been increasing recently. To supply the increased volume of fresh vegetables using less acres required the application of new knowledge, gained through research, to increase yield per acre. New knowledge about how to increase the productivity of workers who harvest these crops is now needed in order to assure that this food will be harvested and available for the consumer.

The 1974 Census of Agriculture (14) lists about 30 commercial vegetable crops in Illinois. Eight of these exceed a total of 1,000 acres for the State. Although 65% of the horseradish grown in the U.S. comes from Illinois, this crop was not listed so other omissions are also possible. The largest acreage crops were sweet corn (59,200 acres) and green peas (27,700 acres). Both of these crops are 100% mechanically harvested. About 15% of the sweet corn goes to fresh market after being trimmed, graded, packed and hydrocooled. The acreage of tomatoes appears to be decreasing rapidly, reportedly due to the lack of hand labor, acceptable harvest aids, or acceptable mechanical harvesting equipment. The 20 or more crops with less than 1,000 acres in the State are under similar pressure and might possibly become uneconomic if harvest productivity can't be increased.

Mechanical Harvesting. The harvesting operation has changed dramatically since 1960 for some of the vegetable crops grown for processing (1, 15). Mechanical harvesters have increased worker productivity and reduced the high labor requirements (man-hours per acre) which were formerly necessary (12). Where mechanical harvesting is successfully used the harvest and supply of the crop is quite dependable. The workers are more productive, can be paid higher wages, and have better working conditions. Contrasted to this, the harvest operation for fresh market vegetable crops has not changed significantly since 1960. Some increase in labor productivity has occurred due to improved cultural conditions and yields, but this increase is limited to what a worker can physically do. Average hourly wages for these workers, although higher due largely to

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increases in the legal minimum wage level, are much lower than those of non-farm workers because productivity is relatively unchanged. Although the demand for fresh market vegetables is increasing, the acreage probably can't be expanded until new harvesting methods are available which improve worker productivity and wages, provide the consumer with a reliable supply of reasonably priced quality vegetables, and provide the grower with a fair profit.

The shortage of acceptable mechanical harvesting methods today for fresh market vegetables is due to several facts. The initial emphasis in mechanization research was on crops which had large U.S. or State acreage, had high man-hour per acre requirements, and where utilized chiefly for processing. Those crops formed the bulk of the essential food supply. Minor crops could not compete. Fresh market crops are always more difficult to mechanically harvest (except for nut and certain root crops) because of problems with damage during harvest and quality maintenance procedures after harvest. Fresh produce generally has a higher potential value than processing produce to the grower. Damage, poor selectivity of mature crop and incomplete recovery of available crop can quickly result in high economic losses when the crop has a high value. Thus, research on mechanical harvesting of fresh market vegetables has been limited and has resulted in a high proportion of uneconomic solutions. Renewed research efforts and new approaches are necessary in engineering if significant progress is to occur in the mechanical harvesting of fresh market vegetables.

Total mechanization is not necessarily the appropriate solution for every harvesting problem. Labor aids have a definite place in the reduction of harvest labor requirements, as do changes in work methods or cultural practices (6). Multipurpose mobile conveyor belts combined with bulk bins or packing stations can result in a doubling of worker productivity for certain conditions and vegetable crops. A reasonable goal in moving from conventional hand harvesting to a more mechanized method of harvesting is that of removing the high peak labor requriements and ending up with a lower constant labor requirement.

The energy shortage is encouraging, rather than discouraging, changing to mechanized methods in agriculture. Energy oriented studies show that less, rather than more, energy is expended per unit of food provided to the consumer when operations in production agriculture are more highly mechanized (11).

The energy shortage may also favor the expansion of fresh market vegetable production. Fresh produce moved a short distance (a few hours) to large population centers should require less energy expenditure (2) and be of better quality than either processed produce or fresh produce transported several times farther.

Developments to Consider. A few developments are underway which may improve the harvesting of fresh market vegetables. They will be briefly described for some of the vegetable crops in Illinois. If more complete information is needed feel free to contact your Agricultural Extension Office or my office.

Asparagus: Personnel carriers are used as labor aids on a large portion of the sandy Michigan acreage picked for fresh market. Worker productivity for local labor is increased slightly, the crew is organized and there is no significant loss of yield. Various mechanical harvest methods are used on 10 to 15% of the acreage and the harvested product is processed. Yield losses of 25 to 40% may by encountered. The asparagus combine is gaining in popularity because it is fairly fast and harvests a clean product which can be used for fresh market or processing. Present mechanical harvesters have mobility problems on sticky soils after rains. A selective harvester is undergoing extensive field tests in California. A spear length and toughness grader, developed in New Jersey, might allow a grower cooperative to mechanically harvest its product then mechanically grade for packing and processing.

Beans, Snap: Research conducted at Clemson University (3) has shown that mechanically harvested beans can be graded for fresh market if precautions are taken to minimize bean damage, and grading, handling and cooling are used to maintain quality. Some varieties produce the crop toward the outside of the plant more than others, so are better adapted to machine harvest.

Broccolli: Mechanical harvesting is coming closer with varieties which have more uniform maturity and will make a once-over harvest practical. Harvesters are under development. Self propelled and tractor mounted conveyor belts are in use for selective hand harvesting. A commercial machine for packing line use is now available for tying the heads and parts into a bunch for fresh market.

Brussels Sprouts: A tractor-mounted mechanical de-leafer is used to remove the leaves around the stalk prior to harvest. a self-propelled harvester exists which can cut the stalks and elevate them to workers who hand-feed them into mechanical peelers which remove the sprouts. Mechanical trimmers are available to remove bark and leaf stalks attached to the sprouts.

Cabbage: Research conducted at Cornell University (10) has shown that, if properly harvested and handled, cabbage can be mechanically harvested for fresh market. The harvester is basically the same as used for cabbage to be processed.

Cauliflower: A mechanical tyer is available for pulling up and tying the wrapper leaves around the head in a one-time operation prior to harvest (5). A selective mechanical harvester was developed to sense the head size and harvest those that are of proper maturity for fresh market (4). Damage to immature heads results in the machine being uneconomic at present, but research on ways of obtaining better uniformity of maturity is progressing. Growers are considering once-over harvest where both fresh and processing markets are available.

Greens, Leafy: Mustard, turnip, and collard greens have been mechanically harvested and bunched with an experimental harvester (9). Other leafy crops which also might work satisfactorily include upright spinach, endive, leaf lettuce, and beets. A multi-row commercial prototype of this harvester is being built by a manufacturer for grower use in 1980.

Lettuce, Head: The selective mechanical harvesting of head lettuce for fresh market is now technically possible. Adoption of the harvest system, in Arizona and California, will not take place until an optimum packaging and handling system is worked out and the supply of hand labor is inadequate. Some grower-packers are going to non-selective harvesting for shredding the lettuce for fast-food chains. This market may promote the adoption of non-selective mechanical harvesting, which has been available for several years (10).

Melons, Eggplant, Squash: No mechanical harvesting is available or under development for muskmelon, watermelon, eggplant or summer squash. These all require selective harvest and are susceptible to damage. Labor aids in the form of self-propelled or tractor mounted conveyors have been used successfully under some conditions to double worker productivity. An over-the-row multiple-bed pickup machine was developed and tested in California for picking up and loading cantalope picked and placed in rows. The increase in worker productivity was not adequate to pay for the machine. An experimental mechanical harvester developed in California for cantalope resulted in harvested melons having an unacceptable range of maturity, so development was discontinued.

Onions, Green: The mechanical harvester discussed above for leafy greens was modified by installing an undercutting blade to dig and lift green onions. Satisfactory mechanically tied bunches were obtained by manually sorting out undersize and oversize onions, then grouping the onions of acceptable size prior to their entry into the mechanical buncher. More research is planned in 1980 prior to constructing a commercial parototype. A similar approach may work for beets, turnips, etc. which are now pulled and bunched by hand.

Parsnip, Rutabaga, Turnip: Mechanical diggers equipped with toppers have been available for many years for harvesting these root crops. Growers have stated that root damage due to cutting and bruising caused by the topper bars caused excessive storage loss and poor quality for fresh market. Our investigation showed that precision seed spacing must be used during planting to eliminate crowding at maturity. Crowding overloads the topper and results in excessive root damage. The topper must also be equipped with fresh market topper bars and properly adjusted. Quality roots are usually hand topped before packaging. The mechanical topper does not do a satisfactory finish cut for fresh market. We have studied alternative methods of topping, but a better method is not available.

Peppers: A mechanical harvester for processing peppers (several varieties) is being developed by a member of our unit (8). Several commercial harvesters have been built as a result of this research. The open-helix detachment principle, developed several years ago at the University of Georgia, is used to remove the peppers from the standing plant in a once-over harvest. The usefulness of this harvester design for fresh market peppers has not yet been established.

Pickles (gherkin size): A method for producing high yields of small size pickles has been developed by plant breeders. In 1979 we evaluated the use of mechanical harvesters developed for harvesting big pickles. Results suggest that modifications to these harvesters should enable them to pick a high percentage of good quality little pickles. Research will continue in 1980.

Potato, Sweet: Mechanical harvesters are now being adopted for fresh market sweet potatoes. Careful attention to maturity, harvester speed, cushioning in the handling system and proper curing of the harvested tubers is essential if top quality fresh market potatoes are desired. The harvesters operate similar to the white potato harvesters.

Rhubarb: A mechanical harvester for once-over harvesting of rhubarb for processing was developed by a member of our unit (7). The stalks are cut near ground level, elevated to a trimming belt where the leaves are cut off, then conveyed to a bulk box. Commercially built models are available. Some growers have sorted out and packed stalks for the fresh market.

The harvesting research being performed on fresh market vegetable crops is quite limited and should be increased. Research funds and personnel are limiting factors at present, but at some furture date we hope to have the opportunity to expand this area of research if organizations like yours are convinced the research must be done.

I've enjoyed meeting with you and look forward to cooperating with you in the future. As you identify needs for improved harvest techniques feel free to call or write us for advice or information. It's one of the best ways we have of directing research effort to new problems which need to be solved.

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DO COMPUTERS HAVE A FUTURE ON YOUR FARM?

John N. Hubbell

Introduction

Computer prices drop. In the past five years while the cost of almost everything increased at an alarming rate, the cost of using a computer decreased even more rapidly. The main frame, which is the heart of the computer, of a new IBM 4300 model costs about one-sixth of its equivalent 1974 model (4). The price of add-on memory, a major component of today's computer, is about one-fifteenth its 1974 price. The same reductions in price have occurred at the low end of the computing spectrum. Texas Instruments' SR-51, a small scientific calculator, listed for $225.00 in 1975. Today, a comparable model sells for under $40.00 (5). The improved technology which has lowered the price of computers has also reduced the size and the environmental requirements.

The computer's environment. In the past, not only was the computer a big monster, it required a large cage. The computer needed a room with a specially raised floor and controlled temperature and humidity. It also required a large team of programmers to write coding and computer operators to feed it with cards. Today there are small computers that sit on top of a desk and are satisfied with a normal office or home environment. This means that now there are computers that a farm operator can afford to have in his office or home.

Does the vegetable grower need a computer? Now that having a computer on the farm is a possibility, the question a vegetable grower should ask is: do I need a computer? The answer depends on the grower and on the local computer market and available services. The grower should begin with some reading before shopping around. There is a recommended reading list at the end of this paper. To help you in your initial investigation to decide if there is a computer that will benefit your operations, this paper will consider (1) some definitions, (2) possible choices in computer ware and services and (3) uses of the computer.

Definitions

In the computer world, like any other in which there is a rapid growth, definitions often reflect the rapid change. The following brief definitions are adequate for today.

Bit: A binary digit, has a value of 0 or 1 which corresponds to "off" or "on".

Binary numbers: Information is stored in the computer in binary numbers or in some form built up from the binary form. Our regular number system, the decimal system, is based on the number 10. Scientists believe that we developed our system using the base 10 because we have 10 fingers. We use 10 number symbols: 0,1,2,3,4,5,6,7,8, and 9. Consider, for example, the number 236. It is composed of 2 hundreds, 3 tens and 6 ones. Expressed in a mathematical equation:

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$$236 = 2 \times 10^2 + 3 \times 10^1 + 6 \times 10^0$$

$$236 = 2 \times 100 + 3 \times 10 + 6 \times 1$$

$$236 = 200 + 30 + 6$$

In the binary system there are 2 number symbols, 0 and 1. A number such as 1101 in the binary number system is composed of 1 one, no two's, 1 four and 1 eight. Hence 1101 in the binary number system equals 1 + 4 + 8 or 13 in the decimal system. Expressed in a mathematical equation:

$$1101 \text{ in the base two} = 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \text{ in the base } 10$$

$$(1101)_2 = (1 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1)_{10}$$

$$(1101)_2 = (8 + 4 + 0 + 1)_{10}$$

$$(1101)_2 = (13)_{10}$$

Byte: In most computers a byte is composed of eight bits. One number or one letter, that is, one character is usually stored inside the computer in one 8-bit byte. For mathematical calculations numbers occupy more bits.

K or Kilo: K is used to measure the capacity of a computer's memory. 16 K bytes means that there are approximately 16,000 bytes.

Minicomputer: A small computer, costing from $30,000 to $200,000, with a word length of 16 to 32 bits and a memory of 16 to 512 K. (1).

Microcomputer: A smaller computer (also called a personal computer or a home computer), generally costing $3,000 to $30,000, with a word length of 16 bits or less and a memory of about 64 K or less.

Hardware: That part of the computer which is machinery as contrasted with software.

Software: The programs which "control" the computer. Most computer companies provide some software free with their computers. Often special programs and software packages are available at extra cost. A software package may be a set of several programs.

Program: A set of instructions that tells the computer what to do, when to add, when to multiply, when to write a line, etc.

Programming language: Programs are written in a programming or computer language. One has to "talk" or write in a computer language to tell the computer what to do. BASIC (Beginner's All-Purpose Symbolic Instruction Code) is used with most small computers. Fortran is a language used in many scientific programs and it resembles scientific formulas in appearance. COBOL and RPG are common business languages, and often used in programming business applications such as payroll and sales records.

Input: Data that are read by the program. For example, a payroll program may read in the hours worked by each employe during the last pay period.

The hours worked are data which will be input for the program and may be punched into computer cards or entered into the computer through a keyboard.

Output: Answers or reports that are generated by the program. A payroll program may print payroll checks. The payroll checks are output.

Computer terminal: A piece of computer hardware that comes in many forms. For purposes of this paper, a terminal will be described as composed of a typewriter keyboard for entering data, with either a video screen or a printer for output, or both. The terminal can communicate with a computer using an ordinary telephone.

Possible choices for a data processing customer

There are many areas in which one must make a choice. First, for the small business or farm there is a choice of size of computer. Second, there may be a choice between buying or renting the computer hardware and/or software. Third, there is a choice between acquiring your own computer "in-house" or using the services of a computer service bureau. Fourth, consider the possible combination of an "in-house" computer with the service of a service bureau.

Mini- or microcomputer. The microcomputer is smaller and less expensive than the minicomputer. However, there is a lot of confusion in defining a computer as mini-, micro-, home, small, or small business computer. Generally, the micros will have more software or programs available. Also, their vendors will be able to provide better hardware and software support. Computer users experience problems with the hardware and "bugs" in the software. Often the customer requires support from the manufacturer or vendor in order to correct such errors. Many of the micro-computer vendors and some of the minicomputer vendors are relatively small and may not remain in the computer business. Even giant companies, such as RCA and General Electric, have tried the computer business and are now no longer vendors of computers.

To rent or to buy. There are advantages in renting instead of buying. However, many of the mini's and micro's are not not available for rent. If you rent it is less costly (1) to move to a larger computer when you begin to approach your first computer's capacity, (2) to switch to another vendor if service is not satisfactory, or (3) to move to a newer model to take advantage of the lower costs and the rapid advances in computer technology. These advances may bring new features, such as a full color TV screen. Texas Instruments' new 99/4 personal computer at $1,150 has the full color TV screen. Computer watchers predict that it will be down to $650 within one year.

Consider a service bureau. Instead of renting or buying a computer in order to have a computer "in-house", one could consider paying for the services of a computer service bureau. This choice should be considered by a first-time computer user. Even here there are at least two choices of service: (1) batch service and (2) computer time-sharing. In the batch service, the data is picked up at your office on a regular schedule. The bureau then converts the data to machine-readable form, prepares the program or programs needed to process the data, then runs the jobs on the computer which uses the data as input to produce the required output. The output such as payroll checks or inventory reports are returned to your office.

Computer time-sharing in today's environment generally consists of computer terminals which may be connected to regular telephone lines to permit many individuals access to the same computer at the same time. The large time-sharing computer can "talk" to all the terminal users in sequence so quickly that it appears to users that the computer is fully devoted to each of them. For a first-time user, the service bureau provides several advantages. First, a good service bureau will provide the expertise a first-time user lacks. Hence, whether you use the batch mode or the time-sharing mode, the service bureau will provide personnel to aid in putting your first applications on the computer. Second, a service bureau allows the user to enter data processing at a low cost. Rather than invest in a computer, which you may not be able to utilize at its full capacity initially, you pay only for as much computer service as you need. Third, the service bureau can provide you with access to a much larger computer than you would ever buy for yourself. At present, large computers offer a much wider range of application programs than do small computers. These programming packages are available to do many things from general accounting applications to sophisticated operation research applications. Large computers, as viewed by a user such as a time-sharing user, are easy to use yet powerful. The cost of batch service generally is based on a fixed fee plus additional charges depending on how much the different components of the hardware are used, how many lines are printed, how many cards are punched, etc. If the time-sharing mode is selected, the user may want to rent or to buy a computer terminal. The terminal charges involve an additional rent plus telephone line charges. For this additional charge, the user has immediate access to the computer, and the output is returned and printed at the user's site.

Under the category of service bureau, the state universities may be considered. The University of Illinois through its Cooperative Extension Service is actively developing its system called CAMPI (Computer Assisted Management Program of Illinois). By providing access to computers and computer expertise in Michigan and Virginia as well as Illinois, CAMPI is used by the Extension Service to aid the Illinois farmer in acquiring the necessary information to make sound business decisions. CAMPI, while not providing all the traditional services of a service bureau, does provide access to an ever-increasing number of farm management programs.

Combination of an in-house computer with a service bureau. Generally, a user's work load increases to a point at which outside services are no longer less expensive than having an in-house computer. Because in-house computers now are available at a lower cost than before, this point occurs sooner. With this in mind, some service bureaus are selling small computers. Automatic Data Processing, Inc. (ADP), Tymshare, and Computer Service, Inc., now sell Digital Equipment's 2020 system as an in-house computer linked to their time-sharing facilities (2). Keydata offers Data General's Nova minicomputer. A user can process small jobs such as payroll in-house and also utilize a service bureau's large computer with its sophisticated software for large or complex jobs such as predicting future economic conditions.

Uses of the computer

No matter how efficiently a computer and its software perform, their value to the vegetable grower depends on whether or not the grower is able to make functional use of the computer. One might divide data processing into three functional areas: (1) bookkeeping, (2) inventory control and feedback, and (3) forward planning and operations research. Bookkeeping can include not only record keeping for income tax purposes, but also preparing payroll checks and balancing accounts. Inventory control refers to keeping track of inventory and feedback refers to use of the computer to aid in making adjustments to keep the inventory at appropriate levels. The first two areas represent traditional computer applications in which business operations are processed with aid from the computer.

You should decide which of your current business operations can be placed on a computer. Then estimate the transaction volumes and file sizes for each application. Discuss these applications with a vendor. One method of evaluating a vendor's ability and dedication to service is to request a test run of your applications on the vendor's computer system. Such a request helps to measure a vendor's hardware, software, and "peopleware".

The third functional area is relatively new to the small business and to the small farmer. At present the small computers offer a limited amount of support in this area. But the larger computers, through systems such as CAMPI, provide software to handle problems in this area. These are problems involving areas such as capital budgeting, Program Evaluation and Review Technique (PERT), and resource allocation (3). Certain programs are available for specific applications such as sprayer calibration or plant disease identification. A discussion of these various programs is outside the scope of this paper.

The advances in computer technology have domesticated the computer by reducing its cost and its environmental requirements. With some reading and browsing through retail outlets for small computers, you will have a better idea of whether or not you can benefit from using the computer in your vegetable growing venture. Certainly, more farmers will acquire access to computers and will enjoy benefits from the improvements in computer hardware and software.

Recommended Reading

Periodicals available at retail outlets for small computers.

1. Byte, the Small Systems Journal

2. Creative Computing

3. Micro

4. Microcomputing

5. Micro Shopper, the Microcomputer Guide

6. Personal Computing

7. Small Business Computers magazine

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MODE OF ACTION OF VEGETABLE HERBICIDES

Walter E. Splittstoesser

Mode of action. The mode of action of an herbicide is that metabolic event or enzyme system affected by a herbicide which causes or leads to death of the plant. Some herbicides have a single (primary) mode of action, while others affect several metabolic pathways or enzyme systems. This is especially true of those that affect meristematic growth, as this can be regulated by hormone (auxin) concentration, cell division (mitosis), cell differentiation, nucleic acid synthesis and protein synthesis. Enzymes are proteins, and nucleic acids are a part of protein synthesis, so anything which affects nucleic acid or protein synthesis would be expected to affect many metabolic events and enzyme systems.

Herbicides are applied as foliar or soil applications depending on their absorption and translocation patterns. Foliar applied herbicides are usually classified as contact or translocated depending on their site of action and its distance from the site of absorption. While understanding the mode of action of an herbicide is not required in their ordinary use, this knowledge is needed to interpret results in the field in cases of unusual or aberrant actions, and in cases of failure.

The mode of action of herbicides varies from the destruction of cell membranes, as brought about by oils, to complex interactions with enzyme systems. Examples of the latter are the competition of dalapon with pantoate and its inhibition of pantothenic acid synthesis, and by the blocking of oxygen release during photosynthesis by urea and triazine herbicides.

Although many herbicides inhibit enzymes involved in the synthesis of essential metabolites, only a relatively few complete biochemical mechanisms of action have been worked out. Considering the great number of recognized herbicides that are phytotoxic there can be no doubt that many different enzyme systems are affected; few however have been studied and described. For example, only after about 25 years was it found that the phenoxy herbicides (2,4-D) affect RNA synthesis and hence interfere in some way with protein synthesis.

Translocation. In considering translocation one must include both phloem-mobility and xylem-mobility. Phloem-mobile translocated compounds applied to foliage move downward in plants to kill the roots and upward to kill the shoots; they are effective against perennial plants; applied to roots they move to the root tips. Xylem-mobile translocated compounds applied to foliage, move upward to the leaf tips; applied to roots they penetrate the cortical tissues, move into the xylem an proceed to the foliar organs via the transpiration stream. Metham (Vapam) is a co tact material that moves with water in the soil and kills roots by contact; many soil fumigants do likewise when injected into the soil. In contrast, the urea and triazine compounds are xylem mobile; when applied through the soil they rapidly penetrate the roots, ascend into the foliar region, and kill the plants through interference with the biochemistry of photosynthesis.

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Dalapon is a foliarly absorbed, translocated herbicide which moves with the food from leaves to various sinks throughout the plant. The urea and triazine compounds on the other hand, are absorbed from the soil by roots, transported to the foliage via the transpiration stream and distributed throughout the green tissues wherever transpiration is going on.

Of herbicides normally applied to the soil, Balan, Cobex, Tolban, and Treflan are normally not translocated; they kill by inhibiting germination or the growing points. For this reason, these materials, in order to be effective, must be applied so that they thoroughly occupy the zone of soil in which the roots, rhizomes or seedlings are to be killed.

In contrast, when simazine is mixed with soils, all plants growing in the area are affected; these materials are absorbed and translocated to the tops of the plants where they bring about their toxic action.

Selectivity of Herbicides. Selectivity of herbicides is relative, depending on concentration or dosage. All herbicides are phytotoxic; if applied in high enough dosage they kill all plants; if dosage is sufficiently low, no plants die. At dosages between these extremes some plants are killed and some are uninjured.

The first selective herbicides, iron and copper salts in water solution, and dilute sulfuric acid, were effective by differential wetting; containing no surfactant, the droplets of spray bounced off of the leaves of cereal crops but wet the broad leaves of cruciferous weeds. These materials were cheap and effective but demanding of labor and of ideal conditions for application.

Sodium dinitrocresylate (Sinox) was the next selective herbicide that appeared and it was superior because of its high phytotoxicity; not over 4 pounds of active ingredient per acre were required to eliminate most broadleaf weeds, and by adding a pound or so of ammonium sulfate the dosage required was reduced by 50%. But the basic mechanism was still differential wetting; if the dosage was increased the crop suffered; if a surfactant was added the normal dosage injured the crop.

With the appearance of 2,4-D, a new mechanism of selectivity was introduced. Applied as a spray in aqueous solution, or in oil solution, or applied through the soil, 2,4-D killed many broadleaf weeds but was relatively nontoxic to grass species. The mechanism of selectivity resides in the cell and has not yet been fully explained.

The new herbicides introduced in the past 25 years have other types of selectivity. Compounds of low water solubility or those that are strongly fixed in soils, may kill shallow rooted weeds while not injuring the deeper rooted crops. Examples are diuron and simazine as used in orchards and vineyards.

More subtle mechanisms are acting in many cases of herbicide selectivity. Corn, sorghum and other grass species are able to replace the chlorine on the substituted triazine molecule with an OH group. This renders the molecule non-toxic and the crop is spared. When Treflan is absorbed by roots, there is soon an inhibition of secondary root formation. In the case of large seeded crops such as beans, the strong tap root rapidly penetrates the shallow layer of soil holding the herbicide and the plant roots are able to grow normally below this layer. Weed seedlings and seeds germinating in this layer are not able to overcome the root inhibition and die.

The selectivity of linurin (Lorox) between tomato, a susceptible crop, and parsnip a tolerant one, depends upon differential accumulation and metabolism of the chemical; tomato translocates the compound throughout the foliar portion of the plant; parsnip metabolizes the small amount that does reach the tops.

The selectivity of atrazine between susceptible wheat and oats and tolerant corn and sorghum is closely paralleled by loss of chlorophyll by the susceptible plants The primary site of toxic action leading to acute toxicity may be the chloroplasts

Chemical classes of herbicides. Herbicides may be classified by common name, trad name or chemical name. Table 1 gives the herbicides frequently suggested for use on Illinois vegetable fields. The herbicides are grouped chemically and generally have the same mode of action in each classification.

Translocatability is important and knowledge of the potential for both phloem- and xylem-mobility is essential to proper application of herbicides. For perennia weed control by foliar application, phloem mobility is necessary as is knowledge as to the response of each species to each chemical. For perennial weed control by soil application, an understanding of the behavior of a chemical in the soil and the mode of its uptake by roots is essential. Some chemicals are strongly fix in soils whereas some are readily leached. Some are volatile and rapidly lost; with these soil incorporation is essential; others stay unchanged in the soil for weeks or months. Some herbicides break down in the soil within weeks; some persist for months or even years.

TABLE 1. Chemical classes of herbicides and some of their general characteristics

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I. Aliphatic acids (chlorinated)

Dalapon (Dowpow, Basfapon): asparagus-end of season; potatoes-preplant incorporated

Mode of Action: Interaction with sulfhydryl (SH) enzyme systems; panothenic acid inhibition; inhibit cuticle development; inhibit protein synthesis

Symptoms: tubular leaves, inhibited shoot elongation, deformed inflorescences

Translocation: phloem and xylem

Selectivity: annual and perennial grasses, cattails

Precautions: moderate skin and eye irritant, mildly corrosive

Soil: little adsorption, short persistence

II. Aliphatic acids (phenoxy)

1. Acetic acids
   2,4-D - post-emergence, corn
2. butyric acids
   MCPB - post-emergence, peas

Mode of Action: Over (hyper) auxin effect, inhibition of nucleic acid and protein synthesis. Butyrics; converted to acetic by beta-oxidation

Symptoms: epinasty (stem bending); stem splitting. adventitious root formation, swollen shortened roots, strap shaped leaves

Translocation: Moves with photosynthate in the phloem.

Selectivity: Broadleaved weeds, (strong on mustards, weak on smartweeds)

Precautions: Drift to susceptible plants, clean sprayers thoroughly after use

Soil: Persistence varies

III. AMIDES

1. acetamides
   CDAA (Randox) - Pre-emergence, onions
   R-25788 - Safener in Sutan+ and Eradicane
2. acetanilides
   alachlor (Lasso) - Pre-emergence or pre-plant incorporated, sweet potatoes, corn
   propachlor (Ramrod, Bexton) - preemergence, sweet corn, peas

3. <u>other amides</u>
   bensulide (Prefar) - pre-plant incorporated, cucumber, muskmelons, squash, watermelons
   diphenamid (Dymid, Enide) - pre-emergence, tomatoes

Mode of Action: Inhibition of growing points, inhibit protein synthesis

Symptoms: Stunting, tight coleoptile, drawstring on soybean leaf

Translocation: Coleoptile uptake, little translocation

Selectivity: Annual grasses, pigweed, some nutsedge

Precautions: CDAA & propaclor - skin irritant

Soil: Short to medium persistence, little adsorption

IV. Benzoic acids
   Chloramben (Amiben, Vegiben 2E) - Pre-emergence, asparagus, beans, cucumbers, muskmelons, pumpkins, sweet potatoes, squash, watermelons
   Post-emergence, transplant tomatoes and peppers

Mode of Action: hyper-auxin activity, root inhibition, inhibit nucleic acid synthesis

Translocation: move with photosynthate in phloem, move in xylem also

Symptoms: Rootlets leak and growth inhibited, grasses have tubular leaves, broad leafed weeds have cupped leaves, stunting

Selectivity: Broadleaved weed control; foliar applied, some grass control

Precautions: drift to susceptible crops when foliar applied

Soil: medium to short persistence

V. Carbamates

1. <u>Thio (-S) containing</u>
   EPTC (Eptam) - preplant incorporated, snap beans, potatoes
   EPTC (Eradicane) - preplant incorporated, corn
   butylate (Sutan+) - preplant incorporated, sweet corn
   cycloate (Ro-Neet) - preplant incorporated, beets
2. <u>phenyl containing</u>
   Chlorpropham (Furloe) - preplant incorporated, carrots, spinach -post-emergence, onions

Mode of Action: inhibit bud and meristematic growth and cuticle development; probably mitotic (cell division) inhibition

Translocation: low, some xylem

Symptoms: inhibited shoot formation, tubular leaves

Selectivity: Thiocarbamates, varies, Polygonaceae (smartweed, wild buckwheat) usually sensitive. - Phenylcarbamates, annual grasses, nutsedge, pigweed. Other broadleaf control is variable.

Precautions: some volatility, immediate incorporation usually advised

Soil: Short persistence in moist soil, adsorbed to dry soil

VI. Dinitroanilines
benefin (Balan) - pre-plant incorporated, lettuce
dinitramine (Cobex) - pre-plant incorporated, dry beans, peas
profluralin (Tolban) - pre-plant incorporated, beans
trifluralin (Treflan) - pre-plant incorporated, beans, carrots, collards, kale, mustard greens, peas, turnip, transplanted tomatoes and peppers
-pre-emergence, brussels sprouts, broccoli, cabbage, cauliflower, potatoes

Mode of Action: Meristematic inhibition, germination inhibition

Symptoms: Stunting, root inhibition

Translocation: nil

Selectivity: annual grasses, some broadleaf weeds

Precautions: Incorporate to prevent surface loss and placement

Soil: Carryover injury has occurred; highly adsorbed, medium to long persistence

VII. Dipyridiliums
paraquat (Paraquat) - pre-emergence, asparagus

Mode of Action: Contact + photosynthesis inhibition

Translocation: nil

Symptoms: Yellowing and death of tissue

Selectivity: Nonselective

Precautions: Moderately toxic, drift; restricted - use herbicide

Soil: Highly adsorbed, inactivated

VIII. Oils
Petroleum based oils - post-emergence, carrots, celery, dill, parsnips, parsley

Mode of Action:. solubilize the cuticle and cell membranes

Symptoms: yellowing and death of the tissue

Translocation: nil

Soil: no effect

IX. Phenols, substituted
dinoseb (Preemerge - 3, Sinox) - pre-emergence, beans, peas

Mode of Action: Contact action, respiration inhibitors, direct killing

Translocation: little if any

Symptoms: death of contacted tissue

Precautions: highly toxic, skin irritation and staining

Soil: short residual in the soil

Selectivity: Broad leaves are better than grasses

X. Phthalic acids
DCPA -(Dacthal) - pre-emergence, snap beans, broccoli, Brussels sprouts, cabbage, cauliflower, collards, eggplant, horseradish, kale, mustard, onions, sweet potatoes, turnips
naptalam (Alanap) - pre-emergence, cucumbers, muskmelons, watermelons

Mode of Action: DCPA - kills germinating seeds; naptalam - blocks IAA action (auxin effect)

Translocation: varies with product, DCPA has limited translocation; naptalam has translocation in xylem and phloem

Symptoms: Naptalam - plants lose geotrophic response, root distrophy, epinasty
DCPA -- root inhibition, meristematic inhibition

Selectivity: varies with product and use

Precautions: DCPA - wettable powder requires thorough agitation
naptalam - quite soluble, will leach

Soil: DCPA greatly adsorbed by organic matter, naptalam somewhat adsorbed

XI. Triazines

1. Symetrical, Chloro-S-triazines
atrazine (Aatrex) - pre-emergence, post-emergence, corn
cyanazine (Bladex) - pre-emergence, sweet corn
simazine (Princep) - pre-emergence, asparagus, popcorn

2. Methylthio-as-triazines
metribuzin (Sencor, Lexone) -pre-emergence, asparagus; -post-emergence, potatoes; pre-plant incorporated, post-emergence, transplanted tomatoes and peppers

Mode of Action: Photosynthetic inhibition (Hill reaction in PS-II)
Methylthio-triazines have some contact action

Translocation: primarily in the xylem

Selectivity: broadleaves and grasses, stronger on broadleaves

Symptoms: chlorosis (yellowing of foliage), necrosis (death), wilting

Precautions: require thorough agitation; carryover injury to some crops

Soil: highly adsorbed by organic matter in soil, soil persistence varies

XII. Ureas

1. Dimethyl phenylureas
   diruron (Karmex) - established asparagus

2. methoxy-methyl-phenylureas
   chlorbromuron (Maloran) - pre-emergence, potatoes
   liniuron (Lorox) - pre-emergence, potatoes
   -post-emergence, carrots

Mode of Action: Inhibition of Hill reaction (PS-II) in photosynthesis

Symptoms: Chlorosis (yellowing) and necrosis (death), wilting, stunting

Translocation: Xylem

Selectivity: Nonselective at high rates, broadleaves better than grasses at selective rates

Precautions: Mild skin and eye irritants

Soil: Highly adsorbed by organic matter; fairly long soil persistence

XIII. Other Organic Herbicides

1. diphenyl ethers
   nitrofen (TOK) - post-emergence, broccoli, Brussels sprouts, cabbage, cauliflower, horseradish, onions, carrots

Mode of Action: contact

Translocation: xylem and phloem

Symptoms: chlorosis (yellowing), whitening (bleaching) of green tissues

Precautions: mildly corrosive

Soil: broken down in 4-6 weeks

2. pyrazon (pyramin) - pre-emergence, post-emergence, beets

Mode of Action: inhibition of photosynthesis, inhibition of chlorophyll formation

Translocation: xylem

Symptoms: chlorosis (yellowing), bleaching, necrosis (death)

3. bentazon (Basagran) - post-emergence, beans, sweet corn, peas

Mode of Action: inhibit photosynthesis and contact killer

Translocation: Xylem when absorbed by roots - foliar-nil

Precautions: adequate water necessary

Selectivity: Broadleaves

Soil: rapidly leaches

4. glyphosate (Roundup) - post-emergence, corn

Mode of Action: inhibit amino acid synthesis

Translocation: downward in the phloem

Precautions: avoid drift to desirable vegetation

Selectivity: grass greater than broadleaves

Soil: strong, adsorption, inactivated

An excellent reference is: Herbicide Handbook of the Weed Science Society of America. 1979. 479pp. WSSA. 309 West Clark Street, Champaign, IL 61820 ($7.50)

NEW DEVELOPMENTS IN PESTICIDE APPLICATION

L. E. Bode and B. J. Butler

Several new developments in equipment and techniques for applying pesticides are now available or being evaluated. Although none of these new techniques will completely revolutionize and replace our current practices, each has potential in special applications.

Devices for controlling spray drift and target coverage. Engineers have developed nozzles that reduce spray drift while maintaining adequate coverage on the intended target. Spray-nozzle manufacturers have recently introduced low-pressure (LP) flat fan and Raindrop R nozzles. They are designed to reduce drift by increasing the drop size and reducing the number of small drops produced. Measurements at the University of Illinois at Urbana-Champaign (UIUC) and Texas A. & M. have verified that drift deposits are less for both the LP and Raindrop nozzles than with conventional nozzles.

Methods are being studied to develop uniform droplet generators. Vibratory devices are used to pulse the jet streams emitting from orifices to produce a stream of uniform drops. Several systems have been successful in the laboratory, but reliable field equipment has not yet been developed.

Spinning disk, cup, and screen devices, such as the Micronair, Herbi, and Span Spray, use centrifugal force to produce a narrow spectrum of small drops at reduced volumes. Equipment for ultra-low-volume spraying (ULV) or controlled-droplet application (CDA) is now available, ranging from small hand-carried battery-operated sprayers to large units to fit tractor-mounted spray booms. Current research is evaluating these units' effectiveness for pest control.

One means of drift control that has received considerable attention is using thickening agents to increase the viscosity of the spray liquid. Thickeners such as Dacagin, Norbak, Vistik, and invert emulsions are available, but they require extreme care in mixing, and some require special equipment. They generally should be used in high concentrations in the spray tank so that the liquid emitting from the nozzle will be a few times more viscous than water. Currently, the new polyvinyl thickening products such as Nalco-Trol and Target are seeing limited use because they are effective in smaller amounts and are easier to use. They are esentially Newtonian in nature under shear, are less salt-sensitive than many of the other thickeners, and reduce the droplets' rate of evaporation. Field research at UIUC, Texas A. & M., and the University of California indicates that Nalco-Trol concentrations of less than 0.05 percent can reduce drift deposits up to 80 percent.

L. E. Bode is Associate Professor and B. J. Butler is Professor of Agricultural Engineering.

Elecrostatic spraying and use of electrical energy. After 30 or more years of research, charged pesticide sprays have reached the prototype stage. S. E. Law, an agricultural engineer, has developed and patented an electrostatic system in which the droplets are generated within the nozzles in the presence of a high-voltage field. They take on a negative charge and are carried toward the plant canopy by a stream of air.

Laboratory and field tests with Dr. Law's sprayer during the past two years indicate that effective control on several crops can be achieved when one-half the recommended pesticide rate is applied in 8 liters of water per hectare. FMC has built prototype electrostatic sprayers for testing and is determining the feasibility of manufacturing electrostatic spray units for commercial use on field crops. The electrostatic system also shows promise for applying pesticides to vegetables, turf, and orchards and for aerial applications.

Lasco, Inc., Vicksburg, Mississippi, has developed a selective weed control system called EDS (electrical discharge system). It delivers high voltage to a metal barn, which in turn delivers a current through any plant that contacts it, thus destroying the plant cells. At this point, the energy requirements are quite high for any unit having adequate field capacity. Also, mantaining selectivity over a range of conditions seems difficult. Considerable progress has been made, however.

Monitors and guidance systems. Operators have shown considerable interest in using modern electronic systems to improve application efficiency. As a result, several companies have developed monitors that sense the travel speed and total flow to the boom. The operator then inputs his swath width, and the monitor continuously displays the spray rate being applied. Some units can also display the nozzle flow, travel speed, area covered, total volume sprayed, and amount remaining in the tank. Another system is available that maintains a constant application volume regardless of travel speed. There are also monitors that indicate when a nozzle has clogged. One uses a sonic sensor in the nozzle body. Another senses when an electrical circuit through the spray sheet is broken.

For swathing, the commercially available Ag-Nav system uses radio signals that an onboard processor converts to a series of relative locations for the sprayer. A dashboard display then indicates whether the sprayer is on the selected swath or to the left or right of it. Laser guidance systems are also in the developmental stage.

Other special application systems. A fairly recent innovation, made more feasible by the devleopment of the herbicide glyphosate, is the recirculating sprayer. The past two years have seen a high demand for recirculating sprayers to control Johnsongrass, volunteer corn, and other weeds in cotton and soybeans. With this technique, the herbicide is applied only to the weeds which are taller than the crops, and, as a result, the amount of herbicide needed varies with the number and size of the weeds. The amount of herbicide used per acre is thus greatly reduced. The success of the box-and-broadcast recirculating sprayer has led to the development of other types of applicators, such as the roller wiper and rope-wick applicators.

Several other devices for improved pest control are being evaluated. One is the intermittent sprayer for spraying only a small area around a crop plant. Some use mechanical feelers to trigger the spray, and others have electric-eye sensors to activate the system. Another device is the air-blast band sprayer. It uses a shield over the entire crop and injects a pesticide mist under the shield in a stream of air. It gives good coverage and placement with a minimum of drift.

Summary. There are undoubtedly other new developments in pest control that have not been discussed, but we have covered those that currently seem to offer the greatest potential for improving application efficiency. Admittedly, the development of equipment has not kept pace with the development and knowledge of pesticides. This short summary shows, however, that new technology is being developed and that the potential is good for improving application efficiency.

1979 VEGETABLE INSECT SITUATION

Roscoe Randell

Corn Insects. A few corn earworms overwintered under deep snow cover but in general earworm infestations were low until after mid August. European corn borers in the state overwintered into 1979 in numbers higher than any of the past 30 years. First generation corn borers in June were moderately high in early planted fields in the state. Second generation moths were not as prevalent due to disease, wind and rain storms during July. Corn borers and earworms migrating into the state were at their peak in late August and early September. Applications of insecticides during this period gave satisfactory control.

Vine Crops. Cucumber beetles overwintered successfully under debris and snow cover in high numbers. Untreated melons and cucumbers were infested by bacterial wilt transmitted by the beetles when feeding on the young plants.

Squash bug populations on pumpkin fields has increased in each of the past five years. Some fields have very high numbers of adults and nymphs causing severe damage to both foliage and fruit in August and September. There is no effective labeled insecticide for adult squash bug control. Trichlorfon (Dylox) will control many of the nymphs but not the overwintering adults.

Other. Green peach aphids increased to high numbers on green peppers, potatoes and some other vegetable crops. This insect is resistant to many of the insecticides used on vegetables.

Variegated cutworms were very numerous on potatoes, tomatoes and similar crops during late summer.

Roscoe Randell is Associate Professor of Agricultural Entomology.

1979 WORM CONTROL IN SWEET CORN

Roscoe Randell

Insecticide treatments were applied to late planted sweet corn on the Vegetable Crops Farm at Urbana. Insecticides applied included carbaryl as Sevin 80S, Sevin XLR and Sevin SL; Sevin in combination with methomyl (Lannate) and with chlorpyrifos (Lorsban). Methomyl and permethrin (Ambush, Pounce) were applied as well as two Stauffer experimental compounds, R52858 and MV770.

Single row treatments were applied to each plot. Five applications were made over a ten day silking period in August and early September. Four-25 ear samples were checked on September 10 for both worm damage and number of worms present.

There was no infestation of European corn borer or fall armyworm in any of the treated plots or untreated plots. Earworm population averaged over two per ear in the untreated plots.

All treatments were satisfactory except Sevin 80S alone and R52858. Sevin 80S plus Lorsban 4E was very effective as in past year's test.

Roscoe Randell is Associate Professor of Agricultural Entomology.

Corn Earworm* Control 1979 - University of Illinois

Location: Vegetable Crops Farm, Urbana
Planted: July 6, 1979
Variety: Gold Cup
Plot size: Single row plots (1/60 A) with border row between plots.
Application dates: August 24, 26, 28, 31 and September 3.
Harvest date: September 10, 1979

Treatment	Rate A.I./A.	% Ears free of damage	No. of worms/ 100 ears	% Damage tip	side	T & S
Sevin 80S	1.76	71	32	21	8	-
Sevin XLR	1.5	96	10	4	-	-
Sevin SL	1.76	93	11	7	-	-
Sevin & Lorsban	1.20 + 0.5	97	3	3	-	-
Sevin & Lannate	1.20 + 0.225	92	5	8	-	-
Lannate	0.45	94	6	6	-	-
Permethrin	0.2	95	5	5	-	-
R-52858	1.0	11	205	40	5	44
MV 770	1.0	94	14	5	1	-
Untreated	-	3	212	65	-	32

* No European corn borers present.

VEGETABLE CULTIVAR TRIALS

J. W. Courter and C. M. Sabota

Commercial growers and gardeners can often improve yield, time of harvest maturity, quality, and disease resistance by selection of proper cultivars. This is a report of cultivars evaluated in 1979 for adaptability to Southern Illinois.

Methods. New vegetable cultivars of selected vegetables were grown at the Dixon Springs Agricultural Center. The soil is Grantsburg silt loam and the plots were irrigated as needed. Rainfall throughout the summer months was 4 to 7 inches above normal. The planting dates, plant and row spacings, and harvest dates accompany Tables 1 through 8. Seed sources are given on page 11.

Results. The yields and performance of caged tomatoes, peppers, sweet corn, muskmelons and watermelons are given in Tables 1 to 8. For comparison with previous years see the Proceedings of the *Illinois Vegetable Growers Schools* (1,2).

The following new cultivars are worthy of grower testing based on performance in these trials, especially in the southern half of Illinois.

Muskmelon: Summet, G-25VB, Star Trek

Pepper: Hybelle, Lady Belle, Big Bertha, NCX 4013

Tomato: Show-Me, Castlex 105, Main Pak, Royal Flush, Traveler 76

Sweet corn: Florida Stay Sweet, Honeycomb, Bellringer, Cherokee, XP-370, Resister, XP-2527, H-12266

Watermelon: Yellow Baby (early, local market), Improved Triple Sweet, Iopride, Blue Belle

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TABLE 1. INFLUENCE OF CULTIVAR ON INCIDENCE AND SEVERITY OF BACTERIAL WILT OF MUSKMELON, 1979
Nonreplicated
Dixon Springs Agricultural Center

Cultivar[1]	Source	Earliness[2]	Total Yield[2] No.	Total Yield[2] Weight	Melon Size	Wilt Rating[3] 7/23	Wilt Rating[3] 8/27
		(%)	(no/plot)	(lb/plot)	(lb)	(%)	(%)
Summet	A	57	7	27.2	3.9	40	40
G25VB	H	22	9	46.4	5.2	55	70
Topset	PS	0	10	28.8	2.9	30	70
Star Trek	H	5	10	39.2	3.9	20	80
Perfection	SS	57	7	25.7	3.7	50	80
Luscious	P	16	9	41.7	4.4	25	85
Burpee Hybrid	BUR	44	9	43.0	4.8	50	90
Canada Gem	SS	11	9	42.1	4.7	20	90
Ship Master	NK	0	10	25.7	2.6	30	90
Harper Hybrid	SS	56	12	52.6	4.2	15	100
XPH771	A	67	9	36.7	4.1	20	100
Earlisweet	PS	62	16	33.4	2.1	40	100
Scoop	G	100	17	32.9	1.9	60	100
Sweet 'n Early	BUR	72	18	29.2	1.6	80	100
Top Score	PS	36	11	28.2	2.6	60	100
Ambrosia	BUR	33	6	25.8	4.3	60	100
Miami	R	0	6	23.2	3.9	40	100
Earlidew	BA	37	8	23.1	2.9	90	100

[1]Seeded May 15, 1979; transplanted May 31, 1979; spacing 12' x 3'; all rows mulched with black polyethylene; 3 plants per plot. The plants were not sprayed with insecticides. Fungicide applications of Bravo or Benlate were applied on 7 to 10 day intervals.

[2]Early harvest from July 23 to August 1; total yield from July 23 to August 31.

[3]Rating: 0 = no wilt, 100 = 100 percent wilt.

TABLE 2. YIELD AND FRUIT SIZE OF PEPPER CULTIVARS, 1979

Dixon Springs Agricultural Center

Cultivar[1]	Source	Early[2] Yield	Total Yield[2] No.1	Total Yield[2] Total Mkt.	Fruit Size	Notes[3]
		(bu/A)	(%)	(bu/A)	(oz)	
New Ace	BUR	534	81	1336	3.8	S,V, like Ace
Exp. 79-72	G	514	72	1070	4.1	S, semi-blocky
Hybelle	H	486	70	1430	4.2	S, V
NCX 4014	N	407	62	866	3.9	
Lady Belle	H	399	83	1425	4.6	V
NCX 4013	N	383	91	1236	5.3	A,F,S,V,dark,bitter
Marketmaster	G	381	63	1229	3.7	S
Big Bertha	BA	378	95	1080	5.5	T
Staddon's Select	H	373	83	1285	5.2	S,A
PIP	A	361	79	903	4.7	T,A
Exp. 79-74	G	339	50	847	3.1	S,T,V
NCX 4012	N	338	85	965	4.8	P,S,V
Ace	SS	336	80	1084	3.8	S,T,V
PSR 10275	PS	335	93	957	4.9	F,A
Liberty Bell	SS	322	64	731	4.1	V
Keystone RG	SS	316	76	672	4.4	V
Martindale	SS	280	71	1000	4.2	Flat shape
Exp. 79-73	G	268	67	893	3.7	S,T,A
PSR 375	PS	249	94	1081	5.4	F,T,V,A
Pepperoncini	BA	241	99	651	0.8	4-4½" length
Sonnette	N	240	58	1092	3.9	S,T, small
Early Prolific	G	179	35	780	2.7	S,T, small
Dutch Treat	R	45	94	264	1.3	P, yellow

[1]Seeded April 16, 1979; transplanted May 29, 1979; spacing 6' x 2'.

[2]Early yield July 23 to July 30; total yield July 23 to October 9.

[3]Abbreviations: A = Attractive, F = Firm, P = Pointed, S = Sunscald, T = Tapered, and V = Variable Shape

TABLE 3. 1979 REPLICATED TOMATO VARIETY TRIAL

Dixon Springs Agricultural Center

Variety[1]	Source	Total Yield[2] No.1	Total Yield[2] Mkt.	Fruit Size	Culls	Notes[3]
		(lb/pl)	(lb/pl)	(oz)	(no/pl)	
Show Me	UM	11.8 a[4]	13.9	7.4	6	A, F, thick skin
Castlex 105	C	10.7 ab	13.5	7.0	8	A, F, SD
Jet Star	H	10.4 abc	13.3	7.0	8	A, oblate
Castlex 1020	C	7.9 bcd	12.0	6.4	17	C, D, E
Floramerica	UKY	7.5 cd	10.8	7.3	15	C, V, SD
Royal Flush	FM	7.1 d	9.7	7.5	16	C, D, good flavor
Calypso	PS	7.0 d	10.0	6.5	16	C, D, V, F, oblong shape
Red Pak	H	7.0 d	9.3	6.5	17	C, V, D
Main Pak	H	6.6 d	10.3	8.4	12	A, C
Campbell 1327	Y	6.4 d	9.1	6.3	14	C, oblate, SD
Westover	UMY	6.4 d	8.9	7.3	15	C, V, SD

[1]Seeded April 25, 1979; transplanted May 26, 1979; spaced 6 x 2 feet; not pruned and grown in 2½ ft. wire cages.
[2]Total yield from July 19 to August 30.
[3]Abbreviations: A = Attractive, C = Fruit cracking, D = Determinate, E = Early, F = Firm, SD = Semi-determinate, V = Variable fruit size or shape.
[4]Means not accompanied by the same letter are significantly different at the 5% level of probability by Duncan's Multiple Range Test.

TABLE 4. 1979 TOMATO CULTIVAR OBSERVATION TRIAL

Dixon Springs Agricultural Center

Variety[1]	Source	Total Yield[3] No.1	Total Yield[3] Mkt.	Fruit Size	Culls	Notes[4]
		(lb/pl)	(lb/pl)	(oz)	(no/pl)	
Pink Panther	BA	12.2	14.5	6.9	4	A, V, seed mixture
FMC 3032	N	10.7	10.8	2.7	8	D, paste type
Count	PS	9.8	12.8	5.9	9	D,C,GS,firm,early
Campbell 17	SS	8.7	9.5	6.0	18	A
Rutgers 39	H	8.5	10.3	5.4	9	A
Ottawa 78	SS	8.2	12.1	5.0	15	C, V, D
Baron	PS	8.1	10.7	5.9	9	D,C,V, firm,early
Glamour	H	7.4	11.4	6.1	5	A
Tempo	A	7.4	10.7	6.6	13	A, C
Duke	PS	7.1	9.5	7.6	18	A, C, firm
7A863	C	7.0	9.0	4.6	30	C, D
PSR 106776	PS	6.5	9.3	6.6	18	C,V,D
Better Girl	BUR	6.2	8.9	9.1	9	C, V
Castlex 1018	C	6.1	10.7	7.1	14	C, V, D
Supersonic	H	6.0	8.7	7.7	11	C, V
Godfather	HE	5.7	8.1	7.0	15	C, D
PSR 106676	PS	5.6	8.2	6.4	11	C, V, pointed
NCX 3050	N	5.2	8.0	10.8	13	C, V
79-22	G	4.8	7.9	8.1	12	C, GS, D, firm, early
Castlex 1025	C	4.7	7.7	6.5	16	C, V, D
Big Girl	BUR	4.5	10.1	8.3	10	C, V
Earlirouge	SS	4.2	7.8	4.9	17	C, FW, V, early
79-32	G	4.1	6.8	7.7	9	D, C, V, oblate
IXV 22	H	3.4	5.9	5.0	24	C, V, D
The Juice	BA	3.1	5.5	4.7	25	C, D
Winner[2]	A	2.4	4.2	8.2	10	C
NCX 3027	N	2.3	4.5	8.6	19	C, D
XPH 450	A	1.1	4.5	7.5	23	C
City Best	P	-[5]	-	2.3	-	C, V, D
Sweet 'n Early	BA	-	-	2.2	-	
Tigerella	SS	-	-	1.7	-	C, striped novelty

[1]Seeded April 30; transplanted May 26; not pruned and grown in 2½ ft. wire cages. Spacing 6 x 2 feet, yields recorded from 5 plants.
[2]Seeded May 21.
[3]Total yield - July 19 through August 30.
[4]Abbreviations: A = Attractive, C = Fruit cracking, D = Determinate, FW = Fusarium wilt, GS = Green shoulders, V = Variable size or shape
[5]Not harvested for yield

TABLE 5. REPLICATED SWEET CORN TRIALS, 1979

Dixon Springs Agricultural Center

Cultivar[1]	Source	Days to Harvest	Plant Stand	Plant[2] Hgt.	Marketable Yield No.	Marketable Yield Wt.[3]	Ear Characteristics[4] Hgt.	Length	Dia.	Husk[5] Cover	Tip[5] Fill	Comments[6]
			(%)	(cm)		(lb)	(cm)	(mm)	(mm)			
H 12266	H	65	95	162	16.3	2.8	63	190	47	10.0	9.3	
NCX 2019	N	66	95	160	16.3	2.6	55	180	47	7.3	6.3	
H 12166	H	67	95	148	18.3	2.5	58	193	45	10.0	8.3	
Comanche	A	67	95	169	17.0	2.3	66	188	42	8.7	9.7	B
Cherokee	A	68	100	174	15.0	2.1	72	190	41	10.0	9.5	S, loose husk, pulls with shank
Bellringer	H	68	100	153	17.0	2.4	61	182	44	10.0	8.7	A, suckers
Bellgold	H	68	90	153	15.3	2.3	55	180	44	10.0	8.7	S, B
Gold Cup	H	69	71	169	14.7	2.0	62	172	42	10.0	9.3	
Merit	A	69	100	177	15.7	2.7	85	197	46	8.3	8.3	
Golden Gleam	H	71	90	186	16.3	2.5	97	200	42	2.3	7.3	S, tender
Resister	N	72	100	176	18.7	2.9	91	208	47	10.0	9.0	T
H445	H	72	95	191	19.7	2.2	91	177	42	9.7	6.7	S
XP370	A	72	95	163	16.3	2.8	60	210	44	7.7	9.7	A,S, tender
NCX 2009	N	73	100	172	18.0	3.3	85	210	49	10.0	9.0	Processing type
IFS Cr 48534	I	74	95	150	14.3	2.3	74	208	40	5.3	6.0	S,T, suckers

[1]Planting date: June 4, 1979; spacing 1 ft; plots 20 ft; average of 3 replications.
[2]Height from ground to base of tassel.
[3]Weight of 5 ears, husked.
[4]Yellow kernels unless otherwise indicated.
[5]Rating 10 = complete cover or fill.
[6]Abbreviations: A = Attractive ear, B = Blanking, S = Smut, and T = Tapered ears.

TABLE 6. OBSERVATION SWEET CORN TRIALS, 1979

Dixon Springs Agricultural Center

Cultivar[1]	Source	Days to Harvest	Plant Stand	Plant[2] Hgt.	Marketable Yield No.	Marketable Yield Wt.[3]	Ear Characteristics[4] Hgt.	Ear Characteristics[4] Length	Ear Characteristics[4] Dia.	Husk[5] Cover	Tip[5] Fill	Comments[6]
			(%)	(cm)		(lb)	(cm)	(mm)	(mm)			
Starbrite	CR	60	100	120	0	1.5	50	160	37	4	8	Diseased, 5 NM
Dawn	NK	61	95	105	1	2.2	35	190	45	3	4	S,13, NM
Beacon	R	62	86	122	10	2.2	35	160	46	5	5	L
Earligem	S	63	95	115	9	2.2	44	180	44	6	5	L
Platinum Lady	CR	63	95	190	12	2.5	80	200	44	7	9	Diseased, white
A108	H	63	100	162	0	2.5	70	180	47	4	10	Pulls easy, 19 NM
74-1702	R	64	95	134	13	2.6	47	175	47	7	9	
Cr YW7601	CR	64	67	180	15	2.6	65	190	43	8	10	Bicolor
Reliance	NK	67	86	150	15	2.5	62	180	45	6	8	L
Intrepid	CR	68	90	175	16	3.7	60	205	52	6	9	
Jubilee	R	68	95	163	18	3.2	62	205	50	8	10	
Slendergem	S	68	100	140	22	2.1	40	210	38	8	9	Suckers
Carmelet	S	69	86	150	17	3.3	55	195	47	9	10	Loose husk, large kernel
YW 475	H	70	100	136	18	2.8	45	195	46	7	10	Bicolor
W7015	H	70	100	154	19	3.6	72	220	46	8	9	Big kernels
H1256	H	70	86	167	14	2.6	59	182	47	9	8	Suckers
XP2532	A	70	90	174	15	2.8	57	180	50	6	10	
Comet	A	70	100	190	19	3.0	83	210	48	7	9	White
A 118	H	70	95	180	24	2.4	64	170	46	10	8	
YW 2036	H	70	90	164	19	2.5	55	190	42	9	8	Bicolor

continued

Table 6. Observation Sweet Corn Trials, 1979 - continued

Cultivar[1]	Source	Days to Harvest	Plant Stand	Plant[2] Hgt.	Marketable Yield No.	Marketable Yield Wt.[3]	Ear Characteristics[4] Hgt.	Ear Characteristics[4] Length	Ear Characteristics[4] Dia.	Ear Characteristics[4] Husk[5] Cover	Ear Characteristics[4] Tip[5] Fill	Comments[6]
			(%)	(cm)		(lb)	(cm)	(mm)	(mm)			
Burgundy Delight	S	70	90	163	19	2.5	58	185	45	7	9	Tender, white
Earli-Queen	R	70	100	167	18	2.6	68	175	46	9	10	Suckers, white
NCX 2028	N	70	100	168	16	2.8	47	200	45	9	10	S, A, bicolor
Lancer	S	70	100	148	20	2.6	46	205	44	8	9	
Starlet	S	70	95	148	18	3.0	61	210	47	6	9	Suckers
Apache	A	71	100	186	20	2.6	82	180	46	10	10	
Hyb. 207	H	71	100	154	27	2.6	74	230	37	10	10	
Synergistic Intrepid	CR	71	86	159	17	2.6	65	180	46	10	9	B
NCX 2029	N	71	100	164	19	3.1	67	197	48	9	9	No flag leaves
Enterprise	CR	71	90	180	21	3.4	77	220	48	6	8	A, off flavor
Exp. 4798	NK	71	100	156	20	2.7	80	195	42	4	8	Curved ears
XP 2527	A	72	90	163	15	3.0	69	225	42	9	9	A, L, tender
Gold Lady	S	72	100	161	13	2.0	62	210	36	3	9	12 rows
74-3044	R	72	95	162	17	3.2	68	190	50	8	9	
WH 1235	H	72	100	176	12	2.3	98	215	41	5	10	S, white
Commander	A	72	100	190	17	3.1	82	220	46	4	8	A, S
XP 2500	A	72	100	150	14	3.0	57	200	48	9	10	B, loose husk
Exp. 5657	NK	72	67	165	8	2.6	64	190	43	5	6	Small kernel
Exp. 5641	NK	73	62	163	8	2.3	69	205	44	9	9	T
White Lightning	CR	73	90	182	15	2.2	74	180	42	9	9	Tender, white

continued

Table 6. Observation Sweet Corn Trials, 1979 - continued

Cultivar[1]	Source	Days to Harvest	Plant Stand	Plant[2] Hgt.	Marketable Yield No.	Marketable Yield Wt.[3]	Ear Characteristics[4] Hgt.	Length	Dia.	Husk[5] Cover	Tip[5] Fill	Comments[6]
			(%)	(cm)		(lb)	(cm)	(mm)	(mm)			
Hyb. 78-3787	R	73	76	191	16	2.6	84	205	44	9	9	Pulls hard, tough kernel
Exp. 5658	NK	73	100	165	19	3.0	57	200	46	9	7	Diseased
Exp. 2403	NK	73	43	148	4	2.8	30	200	45	6	6	L
Syn. Bi Lightning	CR	74	90	169	15	2.5	78	175	44	9	7	Tender, bicolor
Silver Dollar	CR	74	95	172	21	2.1	90	200	40	7	8	T, white
Exp. 5651	NK	74	90	170	14	2.5	65	190	44	10	7	Loose husk, disease
Hyb. 78-3779	R	76	95	191	21	1.8	112	195	39	10	9	

[1]Planted June 4, 1979; spacing 3 x 1 ft; plots 20 ft.
[2]Height from ground to base of tassel
[3]Weight of 5 husked ears
[4]Yellow kernels unless otherwise indicated
[5]Ratings 0-10, 10 = complete cover or fill
[6]Abbreviations: A = Attractive ear, B = Blanking, L = Lodging, S = Smut, T = Tapered ears

TABLE 7. REPLICATED SWEET CORN TRIALS, 1979
(Extra Sweet Cultivars)

Dixon Springs Agricultural Center

Cultivar[1]	Source	Days to Harvest	Plant Stand	Plant[2] Hgt.	Marketable Yield		Ear Characteristics[4]					Comments[6]
					No.	Wt.[3]	Hgt.	Length	Dia.	Husk[5] Cover	Tip[5] Fill	
			(%)	(cm)		(lb)	(cm)	(mm)	(mm)			
Early Extra Sweet	I	62	96	110	17.0	2.7	32	195	47	5.5	6.0	
Exp. H 78-1855	I	64	91	120	13.0	2.9	37	200	47	3.0	9.5	B
Xtra Sweet 77	I	64	61	125	10.0	3.2	41	202	52	3.5	7.5	S
Exp. 78-16545	I	71	93	159	22.0	2.2	68	212	43	6.0	3.5	Double ears
Illini Xtra Sweet	I	72	80	177	13.5	2.6	69	200	48	7.5	5.5	Pulls hard
Florida Stay Sweet	I	73	87	153	17.0	1.8	68	187	41	10.0	5.5	B, pulls easy

[1]Planting date: June 11, 1979; spacing 1'; plots 22'; average of 2 replications.
[2]Height from ground to base of tassel.
[3]Weight of 5 ears, husked.
[4]All yellow kernels.
[5]Rating 10 = complete cover or fill.
[6]Abbreviations: B = Blanking and S = Smut.

TABLE 8. PERFORMANCE OF WATERMELON CULTIVARS, 1979

Dixon Springs Agricultural Center

Cultivar[1]	Source	Early[2] Yield	Total Yield No.	Total Yield Weight	Melon Size[3]
		(no)	(no)	(lb)	(lb)
YIELD FROM PLOT OF 18 PLANTS					
Seedless Polycross #1	AS	-	46	749	16.3
Iopride	IA	4	40	650	16.2
Improved Triple Sweet	AS	-	48	522	10.9
Seedless #313	AS	2	36	521	14.5
Crimson Sweet	A	-	30	396	13.2
Yellow Baby	KY	13	47	233	5.0
YIELD FROM PLOT OF 3 PLANTS					
Sweet Meat	PS	5	12	116	9.7
Blue Belle	A	2	12	113	9.4
Tatum	A	2	9	101	11.3
Prince Charles	PS	1	8	98	12.3
Mirage	A	-	6	84	16.7
Imperial	PS	-	7	79	11.3
Picnic	A	1	6	77	12.9
Park Whopper	P	3	6	68	11.3
Jubilee WR	A	1	4	56	14.1
PSR 12377	PS	2	4	34	8.4

[1]Seeded May 15, 1979; transplanted June 5, 1979. Spacing: rows 15' apart, plants 3' apart; All rows mulched with 1.5 mil black polyethylene 4' wide.

[2]Early yield from July 23 to August 4; total yield from July 23 to September 28.

1979 SWEET CORN VARIETY TRIAL - COLLINSVILLE

C. C. Doll and J. W. Courter

Cultivar	Source[1]	Days to harvest[2]	Marketable yield: Ears per plant[3]	Marketable yield: wt/ear (in shuck)	Ear characteristics: Height[4]	Ear characteristics: Length	Ear characteristics: Dia.	Comments
			(no)	*(lb)*	*(cm)*	*(mm)*	*(mm)*	
Comanche	A	67	1.3	0.74	64	193	44	Good tip cover; large kernel.
H 12266	H	68	1.1	0.93	65	201	47	Long tip cover; variable growth, tough pericarp; fair flavor.
H 12166	H	68	1.1	0.88	65	191	48	Poor tip cover; pointed tip; short plant; thick ear; fair flavor.
NCX 2019	N	68	1.0	0.79	51	185	47	Poor tip fill; loose shuck; variable maturity; easy pulled; fair flavor.
Gold Cup	H	69	1.3	0.77	78	188	43	Average for the variety.
Cherokee	A	69	1.0	0.85	67	198	42	Single eared; fair quality; hard pulling -- shanks stay on.
A 208	H	69	1.3	1.03	72	216	44	Big ear, loose shuck; uneven maturity; long, slender ear; tender and sweet.
Merit	A	70	1.0	0.92	77	208	47	Ear tends to bend over; fluffy shucks; fair flavor; dark silks.
Guardian	A	71	0.8	0.93	65	211	44	Few open tips, shallow grain; tender; uneven maturity.
Resister	N	72	1.0	0.97	83	208	49	Large, firm ear; no flag leaves; poor tip fill; single-eared.
NCX 2009	N	72	1.0	1.02	84	211	49	Vigorous plant; heavy butt; attractive and well-filled; not sweet.
XP 370	A	73	1.0	0.95	66	208	44	Pointed ear; fair end fill; lots of leaves; second ear was nubbins.
H-445	H	74	1.1	0.80	91	191	42	Good tip cover; poor tip fill; upright ear; double eared.
Golden Gleam	H	74	1.7	0.87	91	213	43	Loose end cover; long, straight ear; double-eared; tan silk.
CR-48534	IFS	75	0.7	0.74	74	218	42	Some open tip; poor tip fill; long, ear.

[1]A = Asgrow; H = Joseph Harris; N = Niagra; IFS = Illinois Foundation Seed.
[2]Days from planting on 05/23/79.
[3]With plant populations of 14,520 plants per acre.
[4]Height to base of ear.

Acknowledgment:
H. Willaredt Farm

MELON CULTIVAR TRIALS, KILBOURNE - 1979

Louis R. Nelms

MUSKMELONS

Twenty-one new and standard cultivars of muskmelons were evaluated at the Illinois River Valley Sand Field at Kilbourne. Commercial plantings usually begin during the first week in May in this area. This trial was planted late during the last week of May.

Methods. Planting: 28 May 79, direct seeded. Thinned to one plant every three feet. Plot size: 7' x 29'; nonreplicated. Fertilization: pre-plant = 300 lb 0-0-60/A, 300 lb 14-14-14/A w/trace elements; postplant = 40 lb N/A as NH_4NO_3 on June 26. Irrigation: Sprinkler, 0.6"/May; 3.7"/June in four applications; 3.0"/July in three applications, 2.2"/August in two applications. Weed control: Prefar 4E, 4 lb ai/A, preplant incorporated; black plastic mulch, exposed width of two feet. Insect and disease control: Spray applications of Sevin early and Sevin plus Bravo later.

Results. The incidence of bacterial wilt was very low in all cultivars. The first cucumber beetle was not observed until June 30.

An unidentified foliar disorder occurred early in one area of the field containing G25VB, XPH 771, Experimental 1211, Supersprint, PCNVB, and Canada Gem. All but Exp. 1211 were seriously affected with a loss of leaves, reduced fruit set, and exposure of fruit to direct sunlight. Exp. 1211 appeared to be resistant and had an exceptionally heavy fruit set.

An early cultivar, PCNVB, produced very large, attractive fruit. A few fruit weight 8 to 8.5 pounds--a size which may reduce market value with some growers.

GQVW and GQM9 did not separate easily from the vine. A few ends tore from the vine at full slip and several cracked around the stem end of the fruit.

Summet is attractive, resembling Gold Star, but is smaller. Star Trek also closely resembles Gold Star, but is larger and matures a few days later.

Dixie Jumbo produced the highest marketable yields. These are very attractive Hales Best type with close, heavy netting and a hard rind at full slip which makes them well suited for shipping. Other melons in this category included Shipmaster (small fruit), Edisto, Planters Jumbo, and Experimental 1211.

Earlidawn was early and large but the fruit lacked the sweetness of later varieties. The earliness of Earlisweet and Supersprint may be prized by the home gardener but the small fruit size will not be acceptable to the commercial grower. What Bushwhopper makes up in saved space in the home garden was lost by the small, bland fruit.

Louis R. Nelms is Assistant Horticulturist, Department of Horticulture.

Harvest Queen did not measure up to Gold Star or Saticoy in yield. The vines of Harvest Queen lacked the vigor of these other varieties and did not offer as much sun protection resulting in more slick spots and burning. Nevertheless, Harvest Queen continues to perform satisfactorily on sandy soils for many commercial growers as does Burpee Hybrid which was not included in this trial.

TABLE 1. PERFORMANCE OF MUSKMELON CULTIVARS, ILLINOIS RIVER VALLEY SAND FIELD, KILBOURNE, ILLINOIS - 1979

Cultivar	Source[1]	Date of first harvest	Melons harvested	Culls	Marketable yield Early[2]	Marketable yield Total[3]	Avg weight
			(no)	(no)	(no)	(no)	(lb)
Earlidawn	H	8/08	17	4	11	13	4.7
Earlisweet	PS	8/08	27	0	23	27	2.2
Supersprint	PS	8/08	12	0	9	12	2.2
PCNVB	H	8/08	14	6	5	8	6.4
GQVW	H	8/09	13	9	3	4	4.9
Summet	A	8/09	22	3	9	19	3.9
GQM9	H	8/10	14	5	9	9	4.7
Gold Star	H	8/12	17	2	10	15	4.3
Dixie Jumbo Hybrid	PS	8/13	26	0	9	26	4.1
G25VB	H	8/15	4	4	0	0	4.7
Star Trek	H	8/17	18	4	5	14	4.8
Jumbo Hales Best	A	8/18	27	3	6	24	4.2
XPH 771	A	8/19	17	7	3	10	3.5
Saticoy	PS	8/19	20	2	4	18	5.1
Shipmaster	NK	8/19	21	0	9	21	2.7
Canada Gem	SS	8/20	8	4	0	4	5.0
Bushwhopper	P	8/20	25	2	1	23	2.1
Harvest Queen	A	8/21	14	5	1	9	4.2
Edisto	A	8/21	17	0	3	17	3.9
Planters Jumbo	A	8/21	18	2	6	16	3.3
Experimental 1211	NK	8/25	26	0	0	26	3.7

[1] We gratefully acknowledge these companies for the seed used in this trial. See page 54 for complete names and addresses.
[2] Early = August 8-21.
[3] Total = by September 21.

HONEYDEWS

Honeydew production occurs primarily in the arid Southwest where low humidities, warm day and cool night temperatures prevail, the growing season is long, and irrigation is practiced. Production of honeydews in the eastern U.S. has been limited by the short growing season in northern areas, and by high humidity and high rainfall which favor diseases. Some new, early maturing and more widely adapted honeydew cultivars have shown promise in the East during the last few years. In 1978, we grew one of the long season cultivars at the Sand Field and were pleased with its excellent, sweet flavor. Our success prompted us to evaluate several cultivars of honeydew melons as well as two crenshaw cultivars in 1979.

Methods. The methods of production were the same as outlined in the muskmelon trial including the use of black plastic mulch.

Results. A wide range in days to maturity occurred in the honeydews. Honey Drip and Farmer's Milky Way matured almost three weeks before Honeydew Green and Tam-Dew (Table 2).

The number of melons harvested were nearly equal in all cultivars except for Golden Honey Moon which was severely diseased early in its growth. This disease occurred only in one area of the planting and did not affect other cultivars.

The high numbers of culls in the four earliest cultivars were due to large cracks caused by excessive soil moisture near the time of harvest. These fruit were left on the vine too long and were irrigated too close to harvest. Allowing the soil to become too dry before irrigating increases fruit cracking. Black plastic mulch should reduce cracking by conserving water and maintaining a more uniform level of moisture than is possible on bare soil.

Fruit should be cut from the vine when the color changes from darker green to a lighter green or white. The blossom end also becomes slightly springy and surface waxiness decreases as the fruit reach the harvest stage. The early maturing honeydews tend to slip from the vine when ripe, a characteristic which can help the home gardener decide when to harvest. More cracking can occur and melons will not stand up as long after harvest if allowed to develop to the slip stage.

Average fruit weight was about 2.5 pounds greater among the latest cultivars than the earliest cultivars.

The two crenshaw cultivars were nearly indistinguishable. Early Crenshaw ripened more fruit during the first two weeks than did Crenshaw.

The vigor of the honeydew and crenshaw cultivars was quite high. The leaves were large and dark green and provided good sun protection to the fruit. Disease incidence was generally quite low. An unusually dry summer at the Sand Field undoubtedly contributed to the success of this planting.

TABLE 2. PERFORMANCE OF HONEYDEW AND CRENSHAW CULTIVARS, ILLINOIS VALLEY SAND FIELD, 1979

Cultivar	Source[1]	Date of first harvest	Melons harvested	Culls	Marketable yield Early[2]	Marketable yield Total[3]	Avg weight
			(no)	(no)	(no)	(no)	(lb)
HONEYDEWS							
Honey Drip	P	8/10	20	7	6	13	5.4
Farmer's Milky Way	KY	8/10	16	8	6	8	4.9
Earlidew	SS	8/18	17	8	4	9	5.1
Honey Sweet	J	8/27	15	6	0	9	5.1
Golden Honey Moon	W	8/28	5	0	0	5	7.6
Honeydew Green	P	8/29	18	0	0	18	8.1
Tam-Dew	P	8/29	16	2	0	14	7.4
CRENSHAWS							
Early Crenshaw	BUR	8/20	12	1	6	11	9.8
Crenshaw	GU	8/20	13	1	2	12	9.1

[1]We gratefully acknowledge these companies for the seed used in this trial. See page 54 for complete names and addresses.
[2]Early = August 8-21.
[3]Total = by September 21.

WATERMELONS

Twenty-two cultivars of watermelon and four seedless watermelon cultivars were planted for comparison with new cultivars. Plantings of watermelon usually begin during the first week of May. This planting was made late so that the main harvest would coincide with our annual field day held on August 30.

Methods. Planting: Four-week-old seedless watermelon transplants in Jiffy 7 peat containers were set out May 17 with pollinators of Sugar Baby. Other cultivars were direct seeded on May 30. Stand was thinned to one plant every six feet in row. Plot size: 7' x 40', non-replicated. Fertilization: Preplant = 300 lb 0-0-60/A, 400 lb 12-12-12/A; Post-plant = 20 lb N/A as NH_4NO_3 on June 28. Irrigation: Traveler--1.5"/June in two applications, 2.6"/July in three applications, 1.6"/ August in two applications. Weed control: Prefar 4E, 4 lb ai/A, preplant incorporated. Black plastic mulch over row, exposed width of two feet. Insect contro Sevin bait around transplants for control of cutworm.

Results. Two of the commercial cultivars, Jubilee and Crimson Sweet, did not set many fruit (Table 3). Otherwise they looked good.

Prince Charles, a new Charleston Gray type, looked very good and performed well. Garrisonian and Charleston Gray also did well.

Iopride performed very well and surpassed all other varieties in total weight produced. This cultivar from Iowa State University has consistently produced higher yields than Crimson Sweet during the last five years of trials at Iowa's Muscatine Island Field Station.

Imperial is a new Crimson Sweet type with somewhat smaller fruit of equally good quality. Petite Sweet, an even smaller Crimson Sweet type, did not possess this excellent quality.

Other cultivars which performed reasonably well included Picnic, Tatum, Park's Whopper, Sweet Meat II, Blue Belle, You Sweet Thing, and Yellow Baby. New Dragon performed poorly.

Kengarden and Sugar Bush are bush varieties. Sugar Bush is more adapted to this area than is Kengarden which was developed in Kentucky.

Vines of the four seedless watermelons were vigorous. Early fruit set may have been limited somewhat by a shortage of pollen from diploid pollinators.

TABLE 3. PERFORMANCE OF WATERMELON CULTIVARS, ILLINOIS RIVER VALLEY SAND FIELD

Cultivar	Source[1]	Marketable fruit	Average weight
		(no)	(lb/fruit)
Jubilee W.R.	A	8	36.7
Prince Charles	PS	18	30.8
Garrisonian	T	15	30.1
Charleston Gray	T	18	27.5
Iopride	IA	21	26.5
Crimson Sweet	H	11	20.9
Imperial	PS	24	19.6
Picnic	A	19	18.1
Tatum	A	17	17.0
Park's Whopper	P	28	16.5
Sweet Meat II	PS	24	16.3
Blue Belle	A	17	12.9
You Sweet Thing	P	18	12.0
New Dragon	KY	16	11.0
Petite Sweet	T	18	10.4
Kengarden	P	9	10.1
Sugar Bush	BUR	15	9.5
Yellow Baby	P	24	7.0
- - - - - - - - - -		SEEDLESS MELONS	- - - - - - -
Tri-X-319	AS	9	22.1
Triple Sweet 119	T	9	20.9
Tri-X-313	AS	14	20.2
Improved Triple Sweet	AS	13	16.5

[1]We gratefully acknowledge these companies for the seed used in this trial. See page 54 for complete names and addresses.

SOURCES OF VEGETABLE VARIETIES

We gratefully acknowledge the following companies and universities for seed used in our trials and for information presented on "New Vegetable Varieties" elsewhere in this Proceedings. Inclusion or exclusion of companies in this list does not constitute a recommendation. Not all of these companies sell seeds directly to commercial growers.

A	Leo J. Zanoni, Asgrow Seed Co., Kalamazoo, MI 49001
AC	Abbott & Cobb, Box 307, Feasterville, PA 19047
AG	Agway, Inc., Box 1333, Syracuse, NY 13201
AS	O. J. Eigsti, American Seedless Watermelon Seed Corp., Goshen, IN 46526
BA	Jan P. Umstead, Ball Seed Co., Box 335, West Chicago, IL 60185
BUR	W. Atlee Burpee Co., 615 N. 2nd St., Clinton, IA 52732
C	Dr. F. F. Angell, A. L. Castle, Inc., Box 877, Morgan Hill, CA 95037
CO	Dr. Henry Munger, Plant Breeding Dept., Cornell Univ., Ithaca, NY 14853
CR	Crookham Company, Box 520, Caldwell, ID 83605
D	Desert Seed Co., P. O. Box 181, El Centro, CA 92243
FF	Florida Foundation Seed Producers, Inc., Gainesville, FL 32601
FM	Robert Baermann, Ferry-Morse Seed Co., Box 100, Mountain View, CA 94040
FC	F.M.C. Corp., A.C.D., Western Res. Ctr., P. O. Box 2508, El Macero, CA 95618
G	Paul Orsetti, Goldsmith Seeds, Inc., P.O. Box 1349, Gilroy, CA 95020
GE	Germania Seed Co., 5952 N. Milwaukee Ave., Chicago, IL 60646
GM	H. G. German Seeds, Inc., Smethport, PA 16749
GU	Gurney Seed & Nursery Co., 2nd & Capitol, Yankton, SD 57078
H	Wilbur Scott, Joseph Harris Co., Inc., Moreton Farms, Rochester, NY 14624
HE	Herbst Brothers, Inc., 1000 N. Main St., Brewster, NY 10509
HF	Henry Field Seed & Nursery Co., Shenandoah, IA 51601
HO	Holmes Seed Co., Box 9087, 2125 46th St., NW, Canton, OH 44709
I	Floyd Ingersoll, Illinois Foundation Seeds, R-1, Tolono, IL 61880
IA	Iowa State University, Muscatine Island Field Sta., Fruitland, IA 52749
IC	Idaho Crop Improvement Association, Box 188, Idaho Falls, ID 83401
J	John C. Jung, J. W. Jung Seed Co., Randolph, WI 53956
JS	Johnny's Selected Seeds, Albion, Maine 04910
K	Keystone Seeds, P. O. Box 1438, Hollister, CA 95023
KY	Known-You Seed Co., 26 Chung Cheng 2nd Road, Kaohsiung, Taiwan
LE	Letherman Seed Co., 501 McKinley Ave., NW, Canton, OH 44707
M	Moran Seeds, Inc., 1155 Harkins Road, Salinas, CA 93901
MSU	Dr. S. Honma, Michigan State University, East Lansing, MI 48823
MU	Walter Whitwood, Musser Seed Co., Inc., 1403 Chicago, P.O. Box 787, Caldwell, ID 83605
N	Tom Williams, Niagra Seeds, FMC Corp., Seed Dept., Box 3091, Modesto, CA 953
NCSU	North Carolina Foundation Seed Producers, Inc., North Carolina State University, Raleigh, NC 27650
NI	Nichols Garden Nursery, 1190 North Pacific Hwy., Albany, OR 97321
NK	Iver Jorgenson, Northrup King & Co., 1500 Jackson Street, NE, Minneapolis, MN 55413
O	J. R. Baggett, Department of Horticulture, Oregon State University, Corvallis, OR 97321
P	George W. Park Company, Inc., Greenwood, SC 29647
PS	Paul Thomas, Petoseed Company, Inc., Box 4206, Saticoy, CA 93003

R	John Brewer, Rogers Bros. Seed Co., Box 1647, Idaho Falls, ID 83401
RE	Reed Brothers, Cortland, NY 13045
RS	Robson Seed Farms Corporation, 1 Seneca Circle, Hall, NY 14463
S	George Oswald, Seedway, Inc., Hall, NY 14463
SC	Perry E. Nugent, Research Horticulturist, U. S. Vegetable Laboratory, 2875 Savannah Hwy., Charleston, SC 29407
SS	Stokes Seeds, Inc., Box 548, Buffalo, NY 14240
T	Otis S. Twilley, Box 65, Trevose, PA 19047
TM	Thompson & Morgan, Box 100, Farmingdale, NJ 07727
U	Unwins' Ltd., c/o P. O. Box 9, Farmingdale, NJ 07727
UC	University of California-Davis, Genetics Dept., Davis, CA 95616
UKY	University of Kentucky, Lexington, KY 40506
UME	Northeastern Region Agronomy Research, Science and Education Administration of USDA, University of Maine Life Sciences, Orono, ME 04473
UM	Dr. Victor Lambeth, University of Missouri, Columbia, MO 65201
UMY	Dr. John Bouwkamp, Department of Horticulture, University of Maryland, College Park, MD 20742
V	Vermont Bean Seed Co., Garden Lane, Bomoseen, VT 05732
W	Willhite Melon Seed Farms, Box 23, Poolville, TX 76076
Y	Yopp Seed Company, 217 Washington, Paducah, KY 42001

THE EFFECT OF MDMV ON SEED TRANSMISSION AND POLLEN VIGOR OF SWEET CORN

M. A. Mikel, Cleora J. D'Arcy, A. M. Rhodes, and R. E. Ford

Maize dwarf mosaic virus (MDMV) has appeared for the past three years in northern areas of the U.S. where no perennial host for the virus is known. This has caused interest in seed transmission as a source of primary inoculum in these areas. MDMV also is known to cause sterility in the butts of sweet corn ears (butt blanking) which reduces ear quality and yield. This sterility could be due to either an effect of the virus on pollen vigor, or to an effect on the ovule and/or silk, in either case resulting in less efficient pollination.

Materials and methods. Sixty-one cultivars from the 1978 Urbana field plots as described by Rhodes et al. (2) were tested for seed transmission. Seeds were harvested, dried and planted in the greenhouse over a three month period (100 to 600 seeds per cultivar). Plants were rated at the three leaf stage and plants showing mosaic symptoms were assayed for virus by inoculation to healthy sweet corn seedlings (infectivity assay).

The seven cultivars for the pollen germination test were planted on May 30, 1979 with spacings of 38 inches between rows and 13 inches within rows. Three rows of approximately 50 plants each were planted per cultivar, except for Gold Cup, which had six rows. Rows ran north-south. To minimize spread into controls, the north 14 plants of each row were inoculated in June 21 with an artist's air brush at 80 psi on the youngest leaf. The south 36 plants of each row were uninoculated controls. The inoculum consisted of MDMV-B (Strain B, nonjohnsongrass) diluted 1/4 (w/v) in 50mM sodium phosphate buffer, pH 7.0, with 15 g carborundum/liter added as an abrasive.

Pollen was collected in the morning and germinated on a media containing 15 percent sucrose, 0.03 percent $Ca(NO_3)_2\ 4H_2O$, 0.01 percent H_3BO_3 and solidified with 0.6 percent Bacto Agar (1). After two hours incubation at 25C, the percent germination was determined at 70x magnification. For each cultivar, more than 2000 pollen grains were counted from 10 to 30 plants. After germination counts the pollen was covered with a growth stopping solution of 20 percent glycerin, 3 percent glacial acetic acid, 5 percent formaldehyde and 72 percent water and stored at 4C. These plates were then photographed and magnified and pollen germ tube length was measured. For each cultivar more than 110 germ tubes were measured.

Results. The level of seed transmission averaged 0.07 percent for the 81 cultivars. Only five of the cultivars (Aztec, Bi Queen, Seneca Scout, Sugar Loaf, and Wintergreen) showed seed transmission (Table 1).

M. A. Mikel is Graduate Research Assistant, Cleora J. D'Arcy is Assistant Professor of Plant Pathology, A. M. Rhodes is Professor of Plant Genetics and R. E. Ford is Head, Department of Plant Pathology.

TABLE 1. SEED TRANSMISSION OF MDMV-B IN SWEET CORN

Cultivar	Seed transmission
	(%)
Aztec	0.5
Bi Queen	1.2
Seneca Scout	0.4
Sugar Loaf	0.5
Wintergreen	0.4
Others (56)	0.0

In five of the seven cultivars pollen from healthy plants germinated better than the pollen from virus infected plants, with only Sugar Loaf showing a significant difference (Table 2). In two cultivars (Cherokee and Wintergreen) pollen from virus infected plants germinated better than the pollen from non-infected plants, but not significantly better.

TABLE 2. EFFECT OF MDMV-B ON POLLEN GERMINATION (*IN VITRO*) OF 7 CULTIVARS OF SWEET CORN

	Germination[1]	
Cultivar	Healthy	Virus-infected
	(%)	(%)
Aztec	42	32
Bi Queen	57	55
Cherokee	58	61
Gold Cup	58	48
Seneca Scout	41	32
Sugar Loaf	45	19[2]
Wintergreen	26	39

[1]>2000 pollen grains/cultivar.
[2]Significant at the 1 percent level, students 1 tail t-test.

In all seven of the cultivars MDMV reduced the pollen germ tube length in pollen from infected plants as compared to the germ tube length for pollen from noninfected plants. This difference was significant in five of the seven cultivars (Table 3).

TABLE 3. EFFECT OF MDMV-B ON POLLEN GERM TUBE LENGTH (*IN VITRO*) OF 7 CULTIVARS OF SWEET CORN

Cultivar	Average germ tube length[2] Healthy (μm)	Virus-infected (μm)
Aztec	495	386[2]
Bi Queen	469	400
Cherokee	542	465[2]
Gold Cup	532	361[2]
Seneca Scout	473	306[2]
Sugar Loaf	625	491[2]
Wintergreen	486	444

[1]>110 pollen grains measured/cultivar.
[2]Significant at the 5 percent level, students, 1 tail t-test.

Discussion. Seed transmission of MDMV in sweet corn is quite low, but could be significant from a practical point of view. The scattered infected plants within a field resulting from seed transmission can be early loci of infection from which aphids can rapidly spread virus throughout the field. This must not be interpreted to mean that the five cultivars showing seed transmission are undesirable to use. As this study is expanded and more seeds per cultivar are tested for seed transmission, other cultivars are expected to show similar low rates of seed transmission.

The pollen germination study demonstrates that MDMV has no significant effect on germination *in vitro*. There is, however, a significant correlation between virus infection and pollen germ tube length. After two hours of *in vitro* growth pollen from healthy plants develop longer germ tubes than pollen from MDMV-infected plants. This indicates that pollen from MDMV-infected plants may be weakened by the virus. Weakened, poorly growing pollen could contribute to the inefficient fertilization of sterility at the butt end of the ear since the pollen germ tube must grow further to fertilize these ovules than those at the tip. Work is in progress on pollination *in vivo*, comparing crosses of pollen from healthy and MDMV-infected plants with healthy and MDMV-infected silks. Only after this can a conclusion be drawn concerning the cause of butt blanking.

Acknowledgment. Thanks are expressed to Dr. D. B. Dickenson for consultation on pollen germination.

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A PRELIMINARY STUDY OF THE RESPONSES OF GOLD CUP AND GOLDEN GLEAM SWEET CORN TO WATER STRESS AND MAIZE DWARF MOSAIC VIRUS

Louis R. Nelms, Mark A. Mikel, A. M. Rhodes, and Cleora J. D'Arcy

Sixty-one cultivars of sweet corn were evaluated for tolerance to Maize Dwarf Mosaic Virus (MDMV) at Urbana in 1978. Growing conditions were so favorable that researchers felt that the disease expression in plants inoculated with MDMV (Strain B) was not as different from control plants as might be expected in a less optimum environment. To investigate this hypothesis a preliminary study was conducted in 1979 at the Illinois River Valley Sand Field. Its soil features (Plainfield sand, low water holding capacity, rapidly permeable subsoil) provided a suitable environment to produce water stress in plants by withholding irrigation during dry periods. Two cultivars of sweet corn, Gold Cup (considered susceptible to MDMV) and Golden Gleam (considered to have tolerance) were subjected to three irrigation treatments: (1) optimum water during all physiological stages, (2) withhold water to produce early stress, (3) withhold water to produce late stress. Subplots were inoculated with MDMV (Strains A and B).

Methods. The experiment was planted May 28. Spacings were 36 inches between rows and 12 inches between plants within rows. The experimental design was split-split plot with irrigation treatments as main plots, cultivars as subplots, and virus treatments as sub-subplots. The sub-subplots were paired rows, 20 feet long, replicated four times. One random row of each sub-subplot was inoculated with MDMV (Strains A and B) on June 13. The main plots were not replicated.

Irrigation was provided by overhead sprinklers (irrigation treatments are described in Table 1). All treatments received two irrigations totaling 1.4 inches from planting to inoculation and one of 0.5 inches on June 14. The late stress was planned to occur shortly before and during silking but rain fell during the entire silking period of both cultivars. Following this interruption, the late stress was continued into the grain filling stage.

Plants were sampled on August 21, beyond the market stage. Data were collected on plant height and the characteristics of five representative ears from each row.

Results. Results are presented in Table 2. Due to the lack of replication in irrigation treatment, direct comparisons among irrigation treatments are not as valid as are comparisons made within each irrigation treatment.

Symptoms of MDMV infection were present soon after inoculation. The virus infected plants were shorter, lighter green, and showed more leaf curling in the early stress treatment.

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Early stress delayed development more than late stress. Water stress had no effect on seed set at early and late stages of growth in noninoculated plants. Virus infected plants showed considerable kernel blanking at the center and butt of ears. The blanking was increased by water stress. All irrigation treatments received plentiful rainfall during silking, the physiological stage in which seed set would be most affected by water stress.

Early and late water stress had no effect on ear length, whereas virus infection caused a slight reduction. Acting together, water stress and MDMV caused greater reductions than did either factor acting alone.

In "Gold Cup" water stress without MDMV and MDMV without water stress had the same effect on ear weight. In "Golden Gleam", MDMV without stress caused a greater loss in weight than water stress without MDMV. Again, the combination of limiting factors caused greater reductions in weight than either factor did alone.

Virus infection decreased plant height more than water stress. Water stress plus MDMV had little more effect on final height than MDMV alone in the unstressed plot.

Considering ear characteristics, MDMV plots of "Gold Cup" were about equally affected by early and late stress. The MDMV plots of "Golden Gleam" tended to be more affected by late stress than by early stress. In the 1978 trial in Urbana, "Golden Gleam" showed more tolerance to Strain B of MDMV than did "Gold Cup." In this study, both cultivars were adversely affected to about the same degree by Strains A and B of MDMV. The addition of water stress at early and late stages of growth increased the effects of the virus.

TABLE 1. IRRIGATION TREATMENTS

Treatment	Crop stage	Period of stress	Number irrigations	Total water applied[1]
				(inches)
No stress		-	11	9.3
Early stress	week after inoculation	6/20 - 7/04	9	7.8
Late stress	before silking	7/19 - 7/24	5	3.7
	grain filling	8/06 - 8/21	0	0

[1]Rainfall: Planting - inoculation = 0.44"; inoculation - silking = 1.17"; silking (7/24 - 8/2) = 4.58"; grain filling = trace.

TABLE 2. EFFECTS OF WATER STRESS AND MDMV (STRAIN A AND B) ON PLANT GROWTH AND EAR CHARACTERISTICS OF GOLD CUP AND GOLDEN GLEAM SWEET CORN, KILBOURNE, 1979

				Ear characteristics[2]				
Irrigation treatment	Cultivar	MDMV[1]	Days to 50% silk	Butt fill[3]	Length	Diameter	Weight first ear[4]	Plant[5] height
				(%)	(mm)	(mm)	(lb)	(cm)
No stress								
	Gold Cup	C	57.2	100	176	45	2.3	161
		V	57.5	25	167	43	2.1	115
	Golden Gleam	C	59.0	100	210	45	2.6	178
		V	60.2	30	185	41	1.7	124
Early stress								
	Gold Cup	C	59.2	100	177	43	2.1	145
		V	59.7	20	167	40	1.3	95
	Golden Gleam	C	62.0	100	202	43	2.2	168
		V	62.5	20	186	41	1.6	125
Late stress								
	Gold Cup	C	58.0	100	182	43	2.0	134
		V	59.0	15	165	39	1.3	108
	Golden Gleam	C	60.2	100	207	42	2.2	156
		V	61.2	15	177	38	1.3	108

[1]Treatment: C = control; V = MDMV (Strain A and B); four replications within treatment.
[2]Data are means of five ears per plot.
[3]Percent of ears with no butt blanking.
[4]Combined weight of five ears.
[5]Height to first branch of tassel of average plant at maturity.

APHID NUMBERS AND SPECIES IN AN AREA IN NORTHERN ILLINOIS WHERE MAIZE DWARF MOSAIC VIRUS WAS PRESENT IN 1979

Ellen B. Rest, Cleora J. D'Arcy and Walter E. Splittstoesser

For the past several summers, maize dwarf mosaic (MDM) has occurred in a number of areas in Illinois, including areas near Rochelle, Illinois. The severity of the disease has varied, but the causal agent, maize dwarf mosaic virus (MDMV) has been present each year. The virus is non-persistently transmitted by a number of aphid vectors and is known to overwinter in Johnsongrass (Sorghum halapense L. Pers.). Johnsongrass is rare in northern Illinois, therefore, an examination of other sources of inoculum in this area was begun.

A possible source of virus in northern Illinois could be aphids which carry the virus from infected southern areas. To determine which aphid species were present in the area and at what times during the growing season, aphids were trapped during the summer of 1979.

Materials and Methods

Aphids were trapped in clear plexiglass pans, 6.5" x 6.5" x 1.5". Each pan contained a green ceramic tile in the bottom which did not attract the aphids, but approximated the color of the plant canopy (3). The traps were filled with ethylene glycol and placed on a movable support system so that they were maintained at the level of the canopy throughout the growing season.

The traps were placed in a weedy siderow area May 19 and in an adjacent field plot 100 ft. x 30 ft. planted with sweet corn June 16. The weedy area was downwind (southwest) of the corn area, and the corn plot was surrounded by lima beans.

Pans were emptied weekly and the aphids placed in 70% ethanol for storage until they were identified.

Results

Aphid populations were low until July when numbers began to increase and rose sharply later that month (Table 1). Aphid populations peaked July 20, MDM was first noted in the area July 24 at a frequency of approximately 1 infected plant per thousand (Figure 1). By August 14 virtually 100% of the corn in certain fields was infected with the virus.

Among the aphids trapped, 12 species were found which transmit MDMV (1,2,5,6) (Table 2). However, 88.6% (771 of 870) of the aphids collected have never been tested as vectors of MDMV.

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Table 1. The number of aphids collected in two plots at Rochelle, Illinois in July, 1979

Date	Weedy area (number)	Sweet corn area
Prior to 7/17	53	--
7/17	39	60
7/20	280	124
7/26	248	66

Table 2. Known vectors of MDMV collected in pan traps

Aphid	Weedy area (number)	Sweet corn area
Aphis craccivora	10	17
Aphis fabae	18	1
Dactynotus spp.	0	2
Drepanaphis spp.	1	0
Hyadaphis erysimi	1	1
Hyalopterus atriplicis	0	1
Macrosiphum avenae	1	2
Myzus persicae	1	3
Rhopalosiphum maidis	0	7
Rhopalosiphum padi	5	2
Schizaphis graminum	1	2
Therioaphis trifolii	6	7
Total	44	45

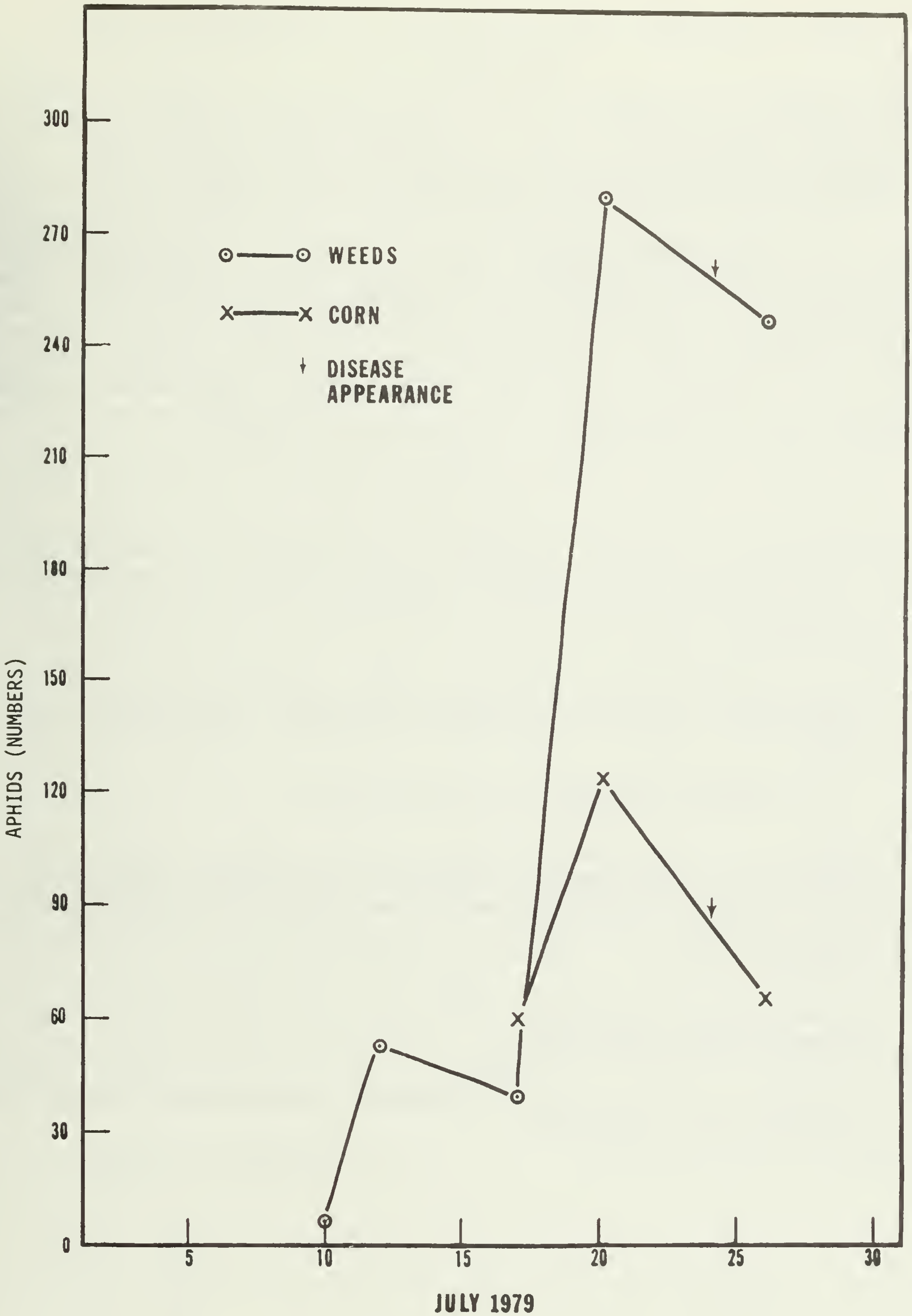

Figure 1. Relationship of aphid populations to appearance of the virus.

Discussion

MDM appeared in northern Illinois shortly after the aphid population had increased dramatically. Since the disease spread rapidly after it appeared it seems likely that aphids are involved in its dissemination in the area, either from a local source or from more distant regions.

Although aphids which have been reported as vectors of MDMV were trapped in the corn and in the weeds their numbers were low in comparison to the aphids which have not been investigated as vectors. In addition, different aphid species transmit MDMV with varying efficiency (4,6). These observations suggest the need to live trap both known and unknown vectors which invade the area; and determine their ability to transmit MDMV and the relative efficiency of transmission. This will allow us to determine which aphid species are the most important in the spread of MDMV.

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BITTER CUCURBITA SPP. AS ATTRACTANTS FOR DIABROTICITE BEETLES

Robert L. Metcalf, A. M. Rhodes, Jane E. Ferguson and Esther R. Metcalf

The attacks of the striped cucumber beetle, Acalymma vittata and the spotted cucumber beetle or southern corn rootworm, Diabrotica undecimpunctata howardi on cultivated Cucurbitaceae and of the corn rootworms D. u. howardi, northern corn rootworm D. longicornis, and western corn rootworm D. virgifera on corn in the Midwest are conservatively estimated to cause damage and expenditures for control aggregating hundreds of millions of dollars annually. Approximately 40 million acres of corn are treated each year with soil insecticides and more than 10 million acres are sprayed to control the adult beetles.

There is need for a satisfactory monitoring and trapping system to determine population densities of adult Diabroticites in order to schedule insecticide treatments and develop integrated pest management programs. Such a system, if effective, could be used to control the beetle populations in small garden plots and in limited acreages of row crops. It is well known that several species of Diabroticite beetles are attracted by the tetracyclic triterpene cucurbitacins (Chambliss and Jones 1966, DaCosta and Jones 1971, and Howe et al. 1976, Metcalf et al. 1978). These cucurbitacin "bitter substances" are specific kairomones for the Diabroticite beetles, acting as arrestants and feeding stimulants. The attacks of these beetles on the foliage and fruits of 18 species of Cucurbita were found to be directly related to the amounts of cucurbitacins B and E present. The cucurbitacin content may range up to 0.3 percent fresh weight in the fruit and root of certain wild Cucurbita species.

The fruits of C. andreana, containing large amounts of cucurbitacin B; and C. texana, containing large amounts of cucurbitacin E glycoside were found to be particularly suitable as trap crops or for attractant preparations for the Diabroticite beetles. In our preliminary experiments, approximately 100 g. of squash fruit were homogenized in 500 ml. of water to make a thick paste. This was poured into 10 in. paper pie plates so that each plate contained about 15 g. of homogenate. In a typical experiment using C. texana fruit and three replicate traps placed around the perimeter of a planting of about 400 sq. ft. of C. andreana, the following average numbers of Diabroticite beetles were attracted:

minutes of exposure	average number of beetles
5	16
10	21
20	75
30	154
60	197
120	355

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In these traps, the beetles, largely D. undecimpunctata with some D. virgifera and A. vittata compulsively ate the squash homogenate until it was totally consumed in about 5 hours. The effectiveness of such traps was greatly improved by adding from 0.01 to 0.1 percent w/v of the contact insecticides trichlorfon or methomyl. These poisoned traps killed the feeding beetles within 5 minutes and up to 1000 beetles within 4 hours. We estimate the cost of the individual traps as less than $0.10. C. texana and C. andreana produce large numbers of fruits under Illinois conditions and sufficient quantities will be grown to explore the practicality of trapping Diabroticites to protect home gardens and to determine population densities in corn plantings.

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CURRENT RESEARCH WITH HORSERADISH INSECTS

C. Eastman, D. Sherrod, J. Schultz, C. White, M. McGuire, and K. Wimmer

Present research with insects associated with horseradish is concentrated on two groups: (1) insects which reduce root yield or quality through direct injury or through foliage feeding, and (2) insects serving as vectors of disease agents which may contribute to outbreaks of brittle root. During the tour demonstration the facilities and equipment used to investigate these areas were examined and the work in progress was briefly reviewed.

Most of the work on the first group deals with the imported crucifer weevil, Baris lepidii, a European pest of crucifers which was found infesting U.S. horseradish in 1977. Studies on the biology of this insect under field and laboratory conditions are being completed, and current research is directed towards determining the field populations of weevils necessary to cause economic damage and in developing an integrated program to control this insect through insecticide dips of planting stock and through destruction of volunteer horseradish, which serves as an off-season insect reservoir. In addition to the work with Baris, studies are underway to determine the amount of insect defoliation horseradish plants can tolerate without affecting root size or quality.

Because of an outbreak of brittle root in horseradish in 1979, a team of entomologists, plant pathologists, and horticulturists is expanding the research begun on this disease after the last outbreak in 1975. Intensive field studies were conducted to collect data useful in helping to determine the possible role(s) of insect vectors, variations in soil type/fertility, weather, planting stock, and cultural practices in initiation and/or spread of brittle root. Additional work in progress involves (1) isolation of disease agents from "healthy" and brittle root plants, (2) transmission studies with suspected insect vectors, and (3) exposure of horseradish plants to various temperature and soil moisture combinations in an effort to trigger production of brittle root symptoms.

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CURRENT RESEARCH AND DEMONSTRATION OF INSECT TRAPPING METHODS

John Shaw and Roscoe Randell

Sampling insect populations:

Sound pest management programs depend heavily on our ability to sample the pest population accurately and efficiently. Current research in Illinois is directed toward the black cutworm (*Agrotis ipsilon*) and consists of two parts, both of which are aimed at early spring detection of adults and larvae.

At present our work with the black cutworm pheromome traps have indicated that for early spring adult flight detection the pheromone traps are much more reliable than the black light traps.

Illinois is also helping to collect data for the University of Missouri on early black cutworm larval detection prior to crop emergence. At present these traps are just in the research stage and some modifications will have to be made, however, early indications are that they have great promise, since they allow us to detect larvae prior to any crop damage.

For populations of earworm, armyworm, and corn borer the black light trap still is our most effective monitoring tool.

John Shaw, Assistant Supportive Scientist, Illinois Natural History Survey, and Roscoe Randell, Associate Professor, College of Agriculture, University of Illinois and Illinois Natural History Survey.

PUMPKIN SEEDLING EMERGENCE AS AFFECTED BY SEED SIZE AT PLANTING AND SOIL TYPE

Mack A. Wilson and Walter E. Splittstoesser

Seedling emergence and yield of many horticultural crops is influenced by seed quality. Larger seeds of lettuce produce greater yields and heavier seeds of snap beans, lima beans and cucumbers resulted in plants which produced greater marketable yields. Seeds of many crops are commercially separated and sold according to seed size. This study was conducted to determine the influence of pumpkin seed size on seedling emergence and subsequent yield.

Seeds of 'Dickinson Field' pumpkin (Cucurbita moschata Poir.) were separated into small (110-130 mg), medium (150-170 mg), and large (190-210 mg) and planted in a Drummer silty clay loam soil and in a Plainsfield sand. The experimental design was a randomized complete block of 3 seed sizes with 4 replications. Rates of fertilizer were applied as suggested from soil tests. Seeds were planted in rows 1.5 km long and 0.8 m apart, with 2 m between rows. Bensulide (Prefar) was applied and soil incorporated 1 day before planting for weed control; Carbaryl (Sevin) and Chlorothalonial (Bravo) were used as needed for pest control. Plots were irrigated as needed.

The number of surviving plants was determined 3 weeks after planting as an indication of seedling emergency. Fruit was harvested 80 days after planting, and the number and weight of fruit per plot determined. As there was no significant difference between 1977 and 1978 data, 1978 data is presented for brevity.

Seed size did not affect the number of fruit produced on either the sand or loam soil and thus did not affect yield. As a result of increased fruit weight, fruit yields from plants from large seeds were significantly greater on the sand soil than those from small or medium seeds (Table 1). As plant emergence and numbers of fruit produced were not significantly different between seed sizes, we have no explanation for larger seeds producing a greater yield. However, yields on the sand soil were always less than those on the loam soil, indicating that plants grown on sand were not yielding according to their genetic potential. When cucumbers were grown on compacted soil, their yield was about half that produced on noncompacted soil, regardless of the seeds weight.

There was no relationship between seedling emergence and total fruit weight (Table 1). More seedlings remained on the sandy soil but these plants did not produce more fruit or more fruit weight. Only 49% of the seedlings produced from small seeds survived on the loam soil but these plants produced as great a yield as any other treatment. Yields were more dependent upon soil type and/or other factors than seedling emergence.

The loam soil used in this study had a high exchange capacity with 5% organic matter. Due to this high organic matter content and previous high fertility regimes,

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this soil could release up to 200 kg/ha of N if no additional N was added. Due to this high residual fertility and adequate water, yields on the loam soil were always greater than those found on the sand soil (Table 1).

Table 1. Seedling emergence and yield of pumpkin fruit as influenced by seed size at planting.

Soil Type	Pumpkin Seed size (mg)	Emergence (% stand)[z]	Fruit per plot (no.)	Ave. Fruit wt. (kg)	Yield (MT/ha)
Sand	110-130	74a[y]	9a	6.9a	17a
	150-170	80a	9a	6.8a	17a
	190-210	79a	10a	8.1b	23b
Loam	110-130	49a	13a	10.1a	41a
	150-170	61b	15a	9.1a	43a
	190-210	59b	14a	8.7a	42a

[y] Mean separation in columns within soils by Duncan's Multiple Range Test, 5% level.

[z] Counts of surviving seedlings were determined 21 days after planting.

Pumpkin seeds are not separated and planted by size, and the average lot of pumpkin seeds was found to contain 34% small seeds, 50% medium seeds and 16% large seeds with an average seed weight of nearly 200 mg. Large cucumber seeds weigh 25 mg and these seeds produce more yield than small seeds; however, yields are not significantly different from ungraded seeds. Individual seeds of lettuce weight from 0.75 mg to 1.4 mg and the difference in weight between small and large seeds is very great; and this difference in weight might be expected to influence yield. Small pumpkin seeds, however, require 12 days in the dark to use the entire protein reserve. Unless the pumpkin seeds are germinated under severe conditions, a difference due to seed size would not be expected to result in increased seedling emergence or increased yield.

THE USE OF THE BULB TO NECK DIAMETER TO PREDICT ESTABLISHMENT OF TRANSPLANTED ONIONS

Mooneshwar Ramtohul and Walter E. Splittstoesser

The common criterion for determining optimum onion seedling size for transplanting is based on neck diameter. This may be desirable for onion plants grown under conditions favorable for foliage and root growth followed by optimum conditions for bulb development. However, in those cases where seedlings exhibit bulb thickening prior to transplanting, bulb size can be an important factor in determining the suitability of the transplants for bulb development under unfavorable conditions. The attainment of maturity in onion bulbs is influenced by day length and temperature. A longer day length than that required for initiating bulb formation is required for maturity and increasing the length of day hastens maturity. This report shows that the ratio of the bulb to neck diameter or bulbing ratio is important in determining which seedlings will establish after transplanting.

Seeds of 'Yellow Bermuda' and 'Red Burgundy' were sown in a glasshouse on January 15, 1977 and January 30, 1978. Seeds were sown 0.5, 1 or 2 cm apart to induce variation in growth and bulb size. Prior to transplanting, the diameter of the bulb and the neck of the seedlings was measured with a Vernier caliper. Measurements were made on different sides of the bulb and neck and the average for each seedling was recorded. The ratio of the bulb diameter to neck diameter was recorded as the bulbing ratio. Seedlings were separated according to their bulbing ratio and field transplanted into Drummer silty clay loam soil on April 15 and May 3. Twenty days after transplanting, the seedlings which had resumed vegetative growth were recorded.

The experimental design was a 2 x 2 factorial in a randomized complete block of 2 varieties X2 planting dates with three replicates. Each plot was a row 0.5 m long with 5 plants at each bulbing ratio, although individual plants varied somewhat in neck and bulb size. Data at each bulbing ratio and from each individual plant were analyzed by Duncan's Multiple Range Test, Chi square and Pearson correlation coefficients. Results were not significantly different between the two years, transplanting dates or cultivars. The 1978 data for 'Yellow Bermuda' is presented but for brevity, bulbing ratios above 5.83 which did not establish after transplanting are not given.

With the exception of one 'Yellow Bermuda' plant (bulbing ratio = 3.33, data not shown), onion plants with a bulbing ratio above 3.38 did not establish in the field (Table 1). The neck diameter of the seedlings was not correlated with transplanting establishment and seedlings with the smallest and largest bulbing ratio could have identical neck diameters. Although bulb diameter generally increased with an increase in the bulbing ratio (Table 1), bulb size ($r = 0.76$) was not as important as the bulbing ratio ($r = 0.98$) in transplanting establishment. The interaction between the bulbing ration and transplanting establishment was significant at the 0.1% level of probability.

M. Ramtohul was a graduate student and W. E. Splittstoesser is Professor of Plant Physiology, Department of Horticulture, University of Illinois.

Table 1. Relationship of the bulbing ratio to transplant establishment in the field.

Plants established after transplanting			Plants not established after transplanting		
Bulbing ratio	Diameter (cm) Bulb	Neck	Bulbing ratio	Diameter (cm) Bulb	Neck
1.37	0.55	0.40	3.45	1.00	0.29
1.41	0.58	0.41	3.50	2.10	0.60
1.55	0.42	0.27	3.70	1.85	0.50
1.71	0.60	0.35	3.90	2.15	0.55
1.90	0.81	0.42	4.08	1.80	0.44
1.95	0.82	0.42	4.13	1.32	0.32
2.02	0.81	0.40	4.21	1.60	0.38
2.09	0.94	0.45	4.50	2.25	0.50
2.25	1.83	0.81	4.75	1.90	0.40
2.33	1.40	0.60	4.80	2.40	0.50
2.40	1.20	0.50	5.14	1.80	0.35
2.58	1.32	0.51	5.20	1.30	0.25
2.60	1.30	0.50	5.22	2.35	0.45
2.67	1.60	0.60	5.43	1.90	0.35
2.82	1.20	0.42	5.50	1.75	0.32
3.10	1.24	0.40	5.62	2.25	0.40
3.17	1.90	0.60	5.75	2.30	0.40
3.37	1.35	0.40	5.83	1.75	0.30

Bulb sizes of plants which established after transplanting ranged from 0.42 - 1.90 cm, while sizes of those which did not establish ranged from 1.0 - 2.4 cm (Table 1). Seedlings which contained bulbs between 1 and 1.9 cm may or may not establish after transplanting, and 50% of the seedlings contained bulbs in this size range. This again emphasizes that the bulbing ratio is more important than bulb size in transplanting establishment.

Bulbing of onions requires long days, high light intensities, and far-red irradiation. 'Yellow Bermuda' will initiate bulbing under a 12 hr photoperiod after a 100 day growing period. Plants which had a large bulbing ratio had already intitiated bulb formation in these studies. Once an onion begings to form a bulb, leaf emergency ceases and the number of new roots initiated declines; and if the plant is transplanted at this time, the plant does not become established in the field.

Scale leaf formation in the onion bulb is generally induced by long photoperiods, while thickening of the basal parts of the leaf sheath is due mainly to photosynthesis. When bulb thickening occurs, few roots develop and transplanted onions do not become established. Neither the neck nor the bulb diameter is an absolute indicator of resumption of plant growth after transplanting. The ratio of bulb to neck diameter or bulbing ratio can be used to predict establishment in the field.

A small bulbing ratio would occur in plants with a large bulb due to a large number of leaves; and also with a small bulb with a small number of leaves. Seedlings which are grown in a crowded seedbed do not show much bulb thickening at transplanting and have a small bulbing ratio. The bulbing ratio predicts the senescence or resumption of plant growth after transplanting.

ELECTRIC DEER FENCE

Louis R. Nelms

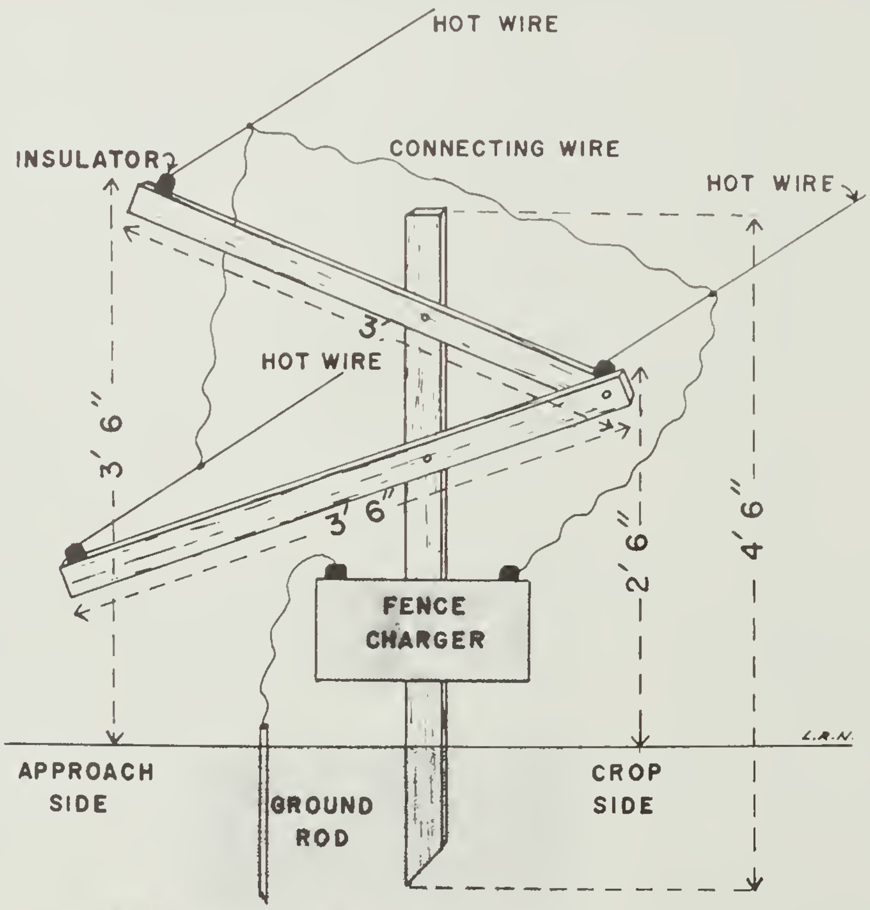
Damage by deer to field experiments has occurred during the last few years at the Illinois River Valley Sand Field. Even a small amount of browsing by deer can seriously affect small experimental units.

In 1978, a commercial deer repellent was applied around some experiments with dubious results. The repellent may have been effective for a short time, but rain soon diluted it. Reapplication of the repellent would have been costly and time consuming. We also tried a reeking combination of blood and bonemeal bound in cloth bags and attached to posts around sweet corn plots. Again, the results were not encouraging.

In 1979, an electric deer fence with three hot wires was erected around the entire Sand Field experimental area with satisfying results. The electric fence was placed 25 to 30 feet inside a woven wire and barbed wire fence. The electric fence can also be placed 15 to 20 feet outside an existing fence. Deer may not be deterred as well if the electric fence is by itself.

The fence was operational before the deer established summer feeding habits in the experimental area. A few deer managed to cross the fence during the growing season but they caused only minor damage to crops. Further observations will be made in 1980.

ELECTRIC DEER FENCE



NOTE: ADAPTED FROM A DIAGRAM BY N.H. FISH AND GAME DEPT

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The materials and approximate costs for fencing 40 acres (approximately one mile of fence) are shown in the table below. The materials needed to construct the post and two arm brackets are based on spacing of 30 feet between posts. However, the posts were spaced 40 feet apart at the Sand Field and performed well. Each wooden post was secured to a steel fence post making the fence stronger and more durable should the wood rot in the ground. This steel post is not shown in the diagram nor is it included in the cost of materials since they were already on hand at the field.

The cost of maintenance during the summer was also not included. Very little time was spent maintaining the fence after construction, but periodic inspection and testing were needed. A chopper-operated fence charger eliminated the problem of weeds and grass growing up and grounding the hot wires. Therefore, no expenses for labor or herbicides to control weeds were incurred.

The cost of fencing 40 acres was not judged to be prohibitively expensive and could be offset by preventing the loss of valuable seedlings or transplants during only one night in a commercial field.

TABLE 1. MATERIALS, ESTIMATED LABOR, AND COSTS OF FENCING 40 ACRES

Materials	Cost in 1979 ($)
Post and 2 arm brackets Sawed hardwood lumber (oak) 175 pcs, 1" x 2" x 12'	115.50
Plastic insulators, 550 @ $0.75/25	16.50
17 gauge wire, 3.5 mile @ $11.98/half mile	84.00
1 chopper-operated electric fence charger	34.00
Miscellaneous materials -- nails, tester, gate connectors, ground rod, etc.	20.00
Labor (estimated) 40 hours @ $3.50/hour	140.00
Total	410.00

The assistance of Forrest Loomis, Wildlife Biologist with the Illinois Department of Conservation is gratefully acknowledged.

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NET WEIGHTS AND PROCESSED YIELDS OF FRUITS AND VEGETABLES IN COMMON RETAIL UNITS

C. M. Sabota and J. W. Courter

The fresh fruits and vegetables listed are grown in Illinois and are sold at roadside stands, farmers' markets, and pick-your-own farms. Common retail units, their equivalent weights, and approximate yields for canning and freezing are tabulated for use by retail marketers.

Containers used in the commercial wholesale trade are not always convenient for selling directly to consumers who often want fruits and vegetables in smaller quantities. The marketer has the option of pricing his produce in small-volume containers or selling by count (single items, a dozen, and so on) when scales are unavailable or cannot be certified.

Retail Containers

Many different kinds and sizes of containers are available for retail selling. Some of the more common ones are listed below. Under the individual crops, they are compared with bushels, lugs, and other containers used in the wholesale trade.

Wood baskets -- round wooden baskets in sizes of 1/4 peck, 1/2 peck, 1 peck, 1/2 bushel and 1 bushel.

Boxes, shipping cartons and hampers -- usually made of corrugated paper, often waxed and ranging in size from 1/2 peck to 1 bushel.

Bags -- of paper and polyethylene, with carrying handles, in sizes from 1/4 peck to 1/2 bushel.

Kraft bags are often used for packaging small amounts. The estimated equivalent volumes of some common sizes of paper bags are:

Grocery bags .... 2/3 bushel	No. 10 bag .... 1-3/4 gal (7 qt)
No. 20 bag ...... 1 peck (8 qt)	No. 8 bag .... 1 gal (4 qt)
No. 2 bag ...... 1 quart	

Trays -- shallow corrugated paper trays are used on pick-your-own berry farms. Common sizes hold 6 to 8 quarts (10 to 15 lb).

Fruit and vegetable baskets -- often made of corrugated paper in sizes from 2 to 8 quarts with carrying handles.

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Fruit tills or cups -- small containers of 1/2 pint to 4 quarts. They are made of several materials, pulp, cardboard, corrugated paper, plastic, and wood. The shape varies with kind of container. Quart berry cups are familiar in most markets.

Definitions and Conversions

Bushel = 2,150 cubic inches, 32 quarts (dry), or 64 pints (dry).

Peck = 1/4 bushel or 8 dry quarts or 538 cubic inches.

Lug = shallow containers, usually wood, that vary in size for different crops; used in wholesale markets.

Gallon = 4 quarts, 231 cubic inches.

Quart = 58 cubic inches.

Kilo (gram) = 2.205 pounds.

Liter = 1.057 quarts (liquid).

FRUITS

Commodity - retail unit	Net weight	Yield
(volume)	(lb)	
APPLES .. (usually sold in volume containers of various sizes)		
bushel	42 to 48	1 peck (32 med. apples) = 4 qt canned
1/2 bushel bag	24	1-1/4 to 1-1/2 lb fresh + 1 pt frozen
peck	10 to 14	2-1/2 to 3 lb fresh = 1 qt canned
		1 bushel = 15 to 18 qt canned applesauce
		= 30 to 36 pt frozen applesauce
		= 16 to 20 qt canned, or 10 to 12 qt of juice
		1 cup pared, sliced = 1/4 lb
APRICOTS		
bushel	50	1 bushel yields 48 to 54 pt frozen
lug	24	1 lug yields 28 to 33 pt frozen
peck	12 to 14	2/3 to 4/5 lb = 1 pt frozen
		1 cup halves, pitted = 1/3 lb
BLACKBERRIES		
6-quart tray	10 to 12	
gallon	5 to 6	1 cup = 1/4 lb
quart	1-1/4 to 1-1/2	1-1/2 to 3 lb = 1 qt canned

Commodity - retail unit	Net weight	Yield
(volume)	(lb)	
BLUEBERRIES		
6-quart tray	10 to 12	1 cup = 1/3 lb
gallon	5 to 6	2-1/4 to 3 lb = 1 qt canned
quart	1-1/2 to 2	1 pt fresh = 1 pt frozen
pint	3/4 to 1	
CHERRIES		
lug	15 to 16	2 to 2-1/2 lb = 1 qt canned, unpitted
quart	1-1/2 to 1-3/4	1 pt = 1 pt frozen, unpitted
pint	1-1/4 to 1-1/2	1 cup = 1/3 lb
GOOSEBERRIES		
quart	1-3/4 to 2	
GRAPES . . (with stems)		
bushel	44 to 50	1 bushel yields 16 qt juice
lug	24 to 28	1 cup (whole, stemmed) = 1/3 lb
2-qt basket	2-1/2 to 3	
PEACHES		
bushel	48 to 52	1 bushel yields 18 to 24 qt canned
1/2-bushel bag	24	2 to 2-1/2 lb = 1 qt canned
lug	19 to 22	1 to 1-1/2 = 1 pt frozen
peck	12 to 14	1 cup = 2/5 lb
PEARS		
bushel	48 to 50	1 bushel = 20 to 25 qt canned
lug	21 to 24	1 to 1-1/2 lb = 1 pt frozen
peck	12 to 14	2 to 2-1/2 lb = 1 qt canned
		1 cup pared, sliced = 2/5 lb
PLUMS		
bushel	50 to 56	1 bushel = 24 to 30 qt canned
peck	13 to 15	2 to 2-1/2 lb = 1 qt canned
		1 cup halves = 1/3 lb
RASPBERRIES		
6-quart tray	8 to 10	1 cup = 1/3 lb
3-quart tray	4	
quart	1-1/4 to 1-1/2	
pint	3/4	
STRAWBERRIES		
quart	1-1/4 to 1-1/2	1 lb = 1 pt frozen
4-quart basket	6	
6-quart basket	10 to 12	
8-quart basket	12 to 15	
8-quart flat	12	
24-quart crate	36	

Commodity - retail unit (volume)	Net weight (lb)	Yield
ASPARAGUS .. (often sold in bunches weighing 1-1/2 to 2 lb each)		
bushel	45	1 to 1-1/2 lb = 1 pt frozen
pyramid crate	32	3 to 4 lb = 1 qt canned
BEANS, LIMA		
bushel	32	1 bu = 12 to 16 pt frozen
peck	8 to 9	3 to 5 lb = 1 qt canned
BEANS, SNAP		
bushel	28 to 30	1 bu = 30 to 45 pt frozen
peck	8	1-1/2 to 2-1/2 lb = 1 qt canned
BEETS .. (often sold in 2 lb bunches with leaves)		
bushel, topped	50 to 56	1 bu = 35 to 42 pt frozen 2 to 3-1/2 lb = 1 qt canned
BROCCOLI .. (usually sold by the head or bunch weighing 1 to 1-1/2 lb)		
bushel	23 to 25	1 bu = 10 to 12 qt canned 1 lb = 1 pt frozen
BRUSSELS SPROUTS		
quart	1-1/2	1 qt = 1-1/2 pt frozen
CABBAGE .. (often sold by the head varying in size with variety and tightness of head, usually 2 to 6 lb)		
crate or mesh bag	50	3 lb = 1 qt canned sauerkraut freezer slaw = 1 lb = 2 cups cooked, or 1 lb = 4 cups shredded
CARROTS .. (often sold in 1 lb bunch with tops)		
bushel, topped	50	1 bu = 32 to 40 pt frozen 2 to 3 lb = 1 qt canned
CAULIFLOWER .. (usually sold as 1 to 1-1/2 lb heads)		
carton of 12 to 16 trimmed	18 to 24	2 medium heads = 3 pt frozen, or 1-1/2 qt canned
CORN, SWEET .. (usually sold by 1 dozen count which weigh 6 to 8 lb in husk)		
5 dozen bag or wire-bound crate	35 to 40	60 ears = 14 to 17 pt frozen, 1 dozen ears = 1 to 1-1/2 qt canned
CUCUMBERS .. (sometimes sold by count)		
bushel	48 to 50	1 bu = 24 qt of dill pickles
peck	12 to 13	

Commodity - retail unit	Net weight	Yield
(volume)	(lb)	
EGGPLANT .. (usually sold by count, 1 to 1-1/2 lb each)		
bushel	33 to 35	2 average = 1 qt canned or 2 pt frozen
KALE .. (also sold in 1 to 1-1/2 lb bunches)		
bushel	18	1 bu = 6 to 9 qt canned, 12 to 18 pt frozen
GREENS .. (mustard, spinach, and turnip often sold in 1 to 1-1/2 lb bunches or bags)		
bushel	18 to 20	1 to 1-1/2 lb = 1 pt frozen
MUSKMELONS .. (usually sold by count; vary widely in size by variety, 3 to 6 lb each)		
bushel	48	
OKRA		
bushel	26	1 bu = 17 qt canned, 34 to 40 pt frozen
ONIONS		
dry, sack	50	
ONIONS (BUNCH, GREEN)		
48 bunches	15 to 18	
PEAS (GREEN, UNSHELLED)		
bushel	28 to 30	1 bu = 12 to 15 pt frozen
peck	7 to 8	3 to 6 lb = 1 qt canned
PEAS (EDIBLE POD)		
peck	8 to 10	
quart	1 to 1-1/2	
PEPPERS (GREEN) .. (often sold by count)		
bushel	25 to 30	2/3 lb = 1 pt frozen large peppers, 80 to 85 per bushel; small peppers, 110 per bushel
POTATOES (IRISH, MATURE)		
sack	100	1 bu = 20 qt canned
bushel	50 to 60	
peck	12 to 15	

Commodity - retail unit	Net weight	Yield
(volume)	(lb)	
POTATOES (NEW)		
No. 10 bag	10	
PUMPKINS .. (usually sold by count)		
Pie pumpkins, each	5 to 15	3 to 4 lb = 1 qt canned
Jack O'Lantern, each	15 to 40	
RADISHES .. (usually sold in bunches of 1/2 to 3/4 lb)		
RHUBARB		
bunch	2 to 2-1/2	1 lb cooked = 3/4 cup
SQUASH (SUMMER) .. (zucchini, crookneck, Patty Pan, etc.)		
bushel	40 to 44	1 bu = 32 to 40 pt frozen
8 qt basket	10	2 to 4 lb = 1 qt canned
SQUASH (WINTER) .. (usually sold by count and may be graded by size)		3 lb = 2 pt frozen 2-1/2 to 3 lb = 1 qt canned
Small .. (such as Acorn, Butternut, Buttercup)		
each	1 to 4	
Intermediate .. (such as Delicious, Golden Hubbard, Banana)		
each	6 to 12	
Large .. (such as Blue Hubbard, Jumbo Banana)		
each	15 to 40	
SWEET POTATOES		
bushel	50	2/3 lb = 1 pt frozen
peck	12 to 13	2 to 3 lb = 1 qt canned
TOMATOES		
bushel	50 to 60	2-1/2 to 3-1/2 lb = 1 qt canned
8 qt or peck basket	12 to 15	1 bu = 15 to 20 qt canned
TURNIPS & RUTABAGA .. (without tops)		
mesh bag or bushel	50 to 56	1 lb = 2-2/3 cups diced
peck	12 to 15	

Selected References

1. Peterkin, Betty and Beatrice Evans. Food Purchasing Guide for Group Feeding. Agriculture Handbook No. 284, USDA. 54 p.

2. Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products. Production and Marketing Administration. USDA. 1952. 96 p.

3. Fulton, Lois, Evelyn Matthews, and Carole Davis. Average Weight of a Measured Cup of Various Foods. Home Economics Research Report No. 41. USDA. 1977. 26 p.

4. Home Freezing of Fruits and Vegetables. Home and Garden Bulletin No. 10, USDA. 1971. 48 p.

5. Seelig, R. A. Container Net Weights. Fruit and Vegetable Facts and Pointers. United Fresh Fruit and Vegetable Association. Washington, D.C. 1970. 4 p.

6. Ball Blue Book. 30th Edition, Ball Corporation, Box 2006, Muncie, Indiana 47302.

7. Home Canning and Freezing Book. Kerr Glass Manufacturing Company, Department 997, Sand Springs, Oklahoma 74063.

8. Handbook of Food Preservation. American Home Economics Association, 2010 Massachusetts Avenue, NW, Washington, D.C. 20036.

Vegetable Varieties 1979-80
for Commercial Market Growers

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN/COLLEGE OF AGRICULTURE/COOPERATIVE EXTENSION SERVICE
CIRCULAR 1174

To obtain optimum yield and quality, it is important for commercial market growers to select vegetable varieties that are adapted to conditions in their locality. This circular provides an up-to-date listing of varieties suitable for Illinois. Not all varieties will be appropriate for all the diverse growing and marketing conditions found in Illinois. In selecting varieties for your operation, you should take into account the preference of your particular market, the time at which the variety can be expected to mature, your methods of culture, and the adaptability of the varieties to your soil and climate. As a further aid, you might consult current catalogs and trade publications for other promising varieties.

Many of the vegetable varieties that show promise for Illinois have only recently been introduced. The names of these varieties are indicated in the following list by the word *trial* in parentheses. The latest results of vegetable trials can be found in the proceedings of the Illinois Vegetable Growers Schools. Copies may be obtained for $3 either from your county Extension office or from the Department of Horticulture, 124 Mumford Hall, University of Illinois, Urbana, IL 61801.

One important advantage of using improved varieties is that they may be resistant to certain diseases. Varieties of cabbage that are resistant to yellows and black rot are indicated by the letters *YR* and *BRR*, respectively.

Additional information on varieties of these and other vegetables may be found in Circular 1150, *Vegetable Gardening for Illinois*. Copies are available for $2 from the Office of Publications, 123 Mumford Hall, University of Illinois, Urbana, IL 61801. When ordering either publication, make checks payable to the University of Illinois.

ASPARAGUS
California Number Series (trial)
F_1 Hybrids (trial)
Martha Washington
Mary Washington

BEAN, SNAP (green)
Astro
Avalanche
Blue Crop
Bush Blue Lake
Cascade
Contender
Del Ray
Eagle (trial)
Early Gallatin
Galagreen
Green Genes
Greensleeves
Harvester
Provider
Slenderette
Spartan Arrow
Sprite Tendercrop
Tenderette
Tendergreen

BEAN, SNAP (yellow)
Gold Crop
Midas
Moongold
Resistant Cherokee
Resistant Kinghorn
Sungold

BEAN, LIMA
Allgreen
Fordhook 242
Thaxter
Thorogreen

BEET
Detroit Dark Red
Explorer
Firechief
Garnet
Gladiator
Honey Red (trial)
Mono-King
Perfected Detroit
Red Ball
Red King
Royal Red
Ruby Queen

BROCCOLI
Gem (trial)
Green Comet
Green Duke (trial)
Premium Crop

BRUSSELLS SPROUT
Green Gem (trial)
Jade Cross Hybrid
Jade Cross Hybrid E

CABBAGE (early)
Emerald Cross
Head Start
Jet Pak
Market Dawn
Market Victor
Resistant Golden Acre
Stonehead

CABBAGE (main crop)
Danish Ballhead
Defender (trial — YR, BRR)

Gourmet (YR)
Greenback (YR)
Green Winter (trial)
Guardian (trial — YR, BRR)
King Cole (YR)
Market Prize
Market Topper
Resistant Danish
Rio Verde
Round-up (YR)
Superette (trial — YR)
Super Green (trial — YR)
Titanic (kraut — YR)

CABBAGE (special)

Savoy
  Savoy Ace
  Savoy King
Red
  Red Acre (YR)
  Red Danish
  Red Head
  Ruby Ball

CARROT

Chantenay Red Cored
Dominator
Gold King (strain or Red Chantenay)
Gold Pak
Grenadier
Hi-Pak Nantes
Pioneer
Royal Chantenay
Spartan Fancy
Tuchon
Tendersweet
Trophy
Waltham Hi-Color

CAULIFLOWER

Imperial 10-6
Self Blanche
Snow Crown
Snow King
Snowball Strains

CHARD

Burgundy (red)
Lucullus (white)

COLLARD

Carolina (trial)
Georgia
Vates

CUCUMBER

Burpee Hybrid
Challenger
Gemini
Pacer (trial)
Poinsett
Poinsett 76 (trial)
Potluck (early, trial)
Saticoy
Marketmore 70
Marketmore 76 (trial)
Slicemaster (trial)
Sweet Slice (trial)
Victory (trial)

CUCUMBER (pickles)

Compass (trial)
Early Pic
Green Pak (trial)
Green Star (trial)
Liberty (trial)
Peppi
Pioneer
Salty
Spartan Dawn
WIS SMR 18

CUCUMBER (greenhouse)

La Reine

EGGPLANT (large oval)

Black Beauty
Black Jack
Black Magic Hybrid
Burpee Hybrid
Classic
Dusky (early, trial)
Jersey King (trial)

KALE

Dwarf Blue Curled Scotch
Dwarf Curled
Dwarf Siberian

LEEK

Conqueror
Electra
Tivi

LETTUCE (greenhouse)

Bibb
Grand Rapids (tip-burn resistant strains)

MUSKMELON

Burpee Hybrid
Early Crenshaw (trial)
Gold Star Hybrid
Harper Hybrid
Harvest Queen
Saticoy Hybrid
Supermarket Hybrid

MUSTARD

Green Wave
Southern Giant Curled

OKRA

Clemson Spineless
Dwarf Green Long Pod
Emerald

ONION (yellow)

Abundance
Autumn Spice
Autumn Splendor
Bounty
Fiesta
Golden Globe
Nutmeg
Ringmaster
Topaz
Yellow Globe

ONION (red)

Benny's Red
Ruby

ONION (transplants)

Benny's Red (trial)
Sweet Spanish types (yellow and white
Ruby (trial)

ONION (green bunching)

Beltsville Bunching
Evergreen Long White
Southport
White Lisbon

PEPPER (bell type)

New Ace (trial)
Bellringer
Better Belle (trial)
California Wonder
Early Calwonder
Early Prolific (trial)
Early Set (trial)
Florida VR-2 (trial)
Keystone Resistant Giant
Lady Bell
Staddon's Select
Tasty
Yolo Wonder

PEPPER (special)

Cubanelle
Hungarian Wax
Jalapeño
Sweet Banana

POTATO (early)

Cobbler
Norchip
Norland
Superior

POTATO (late)
Kennebec
Red La Sota
Red Pontiac

PUMPKIN (small)
Small Sugar
Spookie
Sugar Pie

PUMPKIN (intermediate)
Funny Face
Spirit
Young's Beauty

PUMPKIN (large)
Big Tom
Conn Field
Halloween
Howden Field
Jackpot

SPINACH (spring)
LS Bloomsdale
Melody
Winter Bloomsdale

SPINACH (fall)
Early Hybrid 7
Melody
Old Dominion
Savoy Hybrid
Winter Bloomsdale

SQUASH (summer)
Yellow
- Early Prolific Straightneck
- Golden Girl
- Golden Zucchini (trial)
- Seneca Butterbar Hybrid
- Seneca Prolific

Green
- Zucchini
- Zucchini Hybrid

SQUASH (winter)
Acorn
- Ebony
- Royal Acorn
- Table Ace (semivining)
- Table King (bush)
- Table Queen

Butternut
- Hercules (large)
- Hybrid Butternut
- Regular
- Waltham

Buttercup
Delicious
- Golden
- Green

Hubbard
- Blue
- Golden
- Green
- Improved
- Warted

Kinred
NK 530
NK 580

SWEET CORN (early)
Aztec
Earlibelle
Earliking
Northern Belle
Spring Gold
Sundance

SWEET CORN (main crop)
Bellringer (trial)
Bonanza (trial)
Cherokee (trial)
Gold Cup
Golden Gleam (trial)
Merit (trial)
NK 199
Reliance (trial)
Seneca Chief
Seneca Scout (trial)
Style Pak
Sweet Sal (bicolor)
Sweet Sue (bicolor)

SWEET CORN (late)
Biqueen (bicolor)
Country Gentlemen
Golden Queen
Silver Queen

SWEET CORN (high sugar)
Candy Bar (trial)
Candyman (trial)
Early Xtra Sweet (trial)
Honeycomb (trial)
Illini Xtra Sweet (trial)
Sugar Loaf (trial)

SWEET POTATO
Centennial
Jasper
Nugget

TOMATO (early)
Campbell 1327
Heinz 1350
Heinz 1439
Spring Giant
Springset (north)
Starfire (north)

TOMATO (main crop and late)
Better Boy
Better Girl (trial)
Big Girl (trial)
Bragger (trial)
Burpee VF
Floramerica (trial)
Jet Star
Main Pak (trial)
Pink Wrap (pink)
Red Pak
Royal Flush (trial)
Show-Me (trial)
Sunripe
Super Fantastic
Supersonic
Traveler 76 (pink)
Wonder Boy VF

TOMATO (yellow, orange)
Golden Boy
Jubilee
Sunray

TOMATO (greenhouse)
Michigan-Ohio Hybrid
Ohio WR-13
Ohio WR-25

TURNIP
Just Right Hybrid
Purple Top White Globe

WATERMELON (seeded)
Charleston Gray
Crimson Sweet
Iopride (trial)
Jubilee
Sweet Favorite (trial)
Sweet Princess
Yellow Baby (early, yellow flesh, trial)

WATERMELON (seedless)
These varieties usually require a pollinator and special germination techniques and are usually transplanted.

Tri X 313
Triple Sweet

TIPS FOR GROWING TRIPLOID HYBRID SEEDLESS WATERMELONS

J. W. Courter

Seedless watermelons are a favorite of growers and gardeners who know how to grow them. They are very high in eating quality and demand is increasing in local markets. Seedless melons, however, require special culture and marketing methods.

Triploid seedless watermelons are a hybrid cross between a diploid (standard normal type) watermelon and a tetrapoid (double the normal number of chromosomes) watermelon. They are similar to mules in that they are hybrids between incompatible parents and, like mules, cannot reproduce themselves.

The triploid hybrids, grown from seed of this controlled cross, must be produced each year. The hybrid is sterile and does not produce pollen. Therefore, a regular diploid variety, such as Sugar Baby, must be planted in the field with the triploid hybrid plants as a pollinator.

Hybrids. Improved TRI X 313 is a blocky, green striped melon weighing 14 to 20 pounds or more. The flesh is bright red, sweet, and crisp in texture.

Triple Sweet is a round, light green and striped melon weighing 12 to 14 pounds. The flesh is bright red, sweet, and crisp in texture.

Transplants. Transplants are recommended because triploid watermelon seeds will germinate poorly in direct field planting. The following procedure of starting seeds in Jiffy 7 peat pellets has proven successful, although other potting procedures may work equally well.

1. Soak peat pellets thoroughly and let them drain 24 hours before planting. Do not plant seeds in freshly expanded pellets or a water-soaked soil mix. Do not soak the seeds in water.

2. Plant two seeds per pellet at least one-half inch deep. Insert the seeds upside down (pointed end up). This helps the seedling to shed its seed coat more readily as it emerges.

3. Maintain a temperature of 85°F. for 48 hours. This is a critical period for germination. Do not allow the pellets to become dry but do not soak them if water is needed. Do not place the pellets in a tray of water during this germination period.

J. W. Courter is Extension Specialist in Small Fruit & Vegetable Crops, University of Illinois. *Acknowledgment is given to Dr. O. J. Eigsti for information presented in this outline.*

4. Grow the young seedlings in full sunlight at 75°F. air temperature. The plants will be ready for transplanting in approximately 21 days. Do not grow plants larger than three true leaves. Warmer temperatures stimulate spindly growth.

Transplanting

1. Make sure the pellets are thoroughly wet and handle the plants with care. Avoid windy, cold days for transplanting.

2. Use standard liquid starter fertilizer (such as 10-50-10 or 10-52-17) to get the plants off to a good start. Apply one-half to one cup per hill, keeping the fertilizer solution off of the leaves.

3. Space hills 3 to 4 feet apart in the row and do not thin the seedlings.

4. Space rows 6 to 10 feet apart, depending on tillage equipment.

5. Plant a standard diploid variety (such as Sugar Baby) in every third row for pollination. The pollinator variety may be direct seeded or transplanted. Crimson Sweet is similar in appearance to Triple Sweet and may confuse some growers.

Culture

1. Watermelons, and especially the seedless varieties, respond to soil-warming plastic mulch with increased growth and yields, especially on heavier soils. Apply 3 or 4 foot wide black polyethylene mulch film prior to transplanting. Installation a week before planting significantly warms the soil to benefit early growth and development.

2. Transplant with a commercial mulch-transplanter or cut holes by hand through the film. Hand planting is aided with use of a bulb planter to make holes.

3. Cultivate, spray and irrigate as for standard watermelons.

4. Bees can aid pollination at flowering time if the field is large.

Harvest. Pick the melons when fully mature. Seedless watermelons are late maturing and it is more difficult to judge their ripeness. The underside of the melon becomes deep yellow to orange in color when fully ripe. Growers should cut enough melons to gain experience. The first melons will ripen 10 days, or more, after Sugar Baby. The very first melons may contain small "vestigal" seeds but subsequent pickings should be practically seed-free. Seedless melons will not continue to ripen after they are cut from the vine.

Triploid hybrid seedless watermelons are premium quality. They require care to grow and they are a challenge to pick and to market properly. They have been extremely successful for some growers in Illinois. It is recommended that limited plantings be made for the first year or two until the grower has had experience both in growing and marketing this crop.

NEW VEGETABLE VARIETIES

C. M. Sabota and J. W. Courter

Commercial growers are encouraged to try new varieties and compare them with their standard or favorite ones. The following list includes many new vegetable varieties that may prove to be suitable for growing in Illinois. This listing supplements the new varieties described in the 1979 Illinois Vegetable Grower Schools Proceedings.

The varieties in this report were submitted by seedsmen listed on page 54. Some varieties are only available in small trial quantities (SS) while others are available in commercial quantities (CQ) from the sources given. If no seed source is given for a variety, check your seed dealers for availability. An asterisk (* denotes a hybrid when this information was known. Descriptions of individual varieties are necessarily brief and abbreviations are defined on page 99. Few of the varieties have been tested in Illinois and inclusion does not constitute a recommendation.

The varieties developed for home garden potential and All American Selections (AAS) will be of special interest to commercial bedding plant growers.

What affects performance? Growers are encouraged to test new breeding developments to judge their potential for their market or use. Some factors that influence performance of a variety or hybrid include climate--temperature, rainfall, humidity; soil--type, fertility drainage; season--spring, summer, or fall cropping; culture--planting distances, training methods, mulch, fertilizer treatment; method of harvest--hand or machine; and intended use--fresh, storage, processing, or shipping. These factors vary for different locations in the state.

Trial tips. The followng tips will aid in evaluation of new varieties and hybrids.

1. Limit the number of new ones to try.
2. Compare them with your standard or favorite.
3. Select a location with uniform soil and drainage where all will receive the same spray and cultural treatments. Avoid the edge of a garden where uncontrollable factors (lawn mower, children, dogs, etc.) may influence the results.
4. Plant all the varieties on the same day and in the same way, both in the greenhouse and in the field.
5. Label each row or plant carefully. Draw a map and keep it in a safe place.
6. Record observations of plant growth, yield, disease, and fruit characteristics. These records will help you to make variety decisions next year.

C. M. Sabota is Assistant Horticulturist and J. W. Courter is Extension Specialist, Small Fruit & Vegetable Crops.

University trials. From time to time University horticulturists test varieties at various locations in Illinois. Study the reports elsewhere in this Proceedings. Also consider your location to help you choose the new varieties to try in your area and for your market.

LIST OF NEW VEGETABLE VARIETIES

Variety or hybrid	Company	Principal use for Illinois (H = Home garden, CM = Commercial market)	Brief descriptive notes
BEANS, SNAP			
Blue Duet	FC	CM	Blue Lake, smooth straight pod. CQ
Bush Blue Lake 47	A	CM	Round, medium dark green. CQ
Century Gold	R	H,CM	Long, yellow pods, small seeds.
Checkmate	A	CM	Round, medium dark green. CQ
Conquest	K	H,CM	Straight, 5-6" green pods. CQ
Gold Rush	A	CM	Yellow, round, straight pods. CQ
Golden Butterwax	AG	H	Slender, 6" pods.
Golden Ruler	H	H,CM	Romano wax, 51 days. CQ
Lake Largo	K	CM	Blue Lake, medium dark color, 6½-8". CQ
NCX 8018	FC	CM	Long, attractive pods. SS
Raider	K	CM	Early, Provider type, round.
Scope	FC	CM	Smooth straight pods. CQ
Stretch	A	H,CM	Early, Blue Lake. SS & CQ
Strike	A	CM	Round, straight smooth 5½" pods. CQ
Triumph	NK	CM	Fresh market, adapted to mech. harvest.
White Dutch	C	H	Pole, 90 day; common mosaic, rust resis.
BEET			
Cardinal	PS	H,CM	Early, bright red, tops 10-12".
Pacemaker II*	H,SS	H,CM	Early, red, tender, globe shaped. CQ
Warrier*	H	CM	Smooth, red bunching. CQ
BROCCOLI			
Clipper		H,CM	Very early, erect plant habit.
Coaster		H	Uniform compact plants.
Corvet*	R,U	CM	Medium early, uniform, 60 days. CQ
Green Dwarf	SS	H	Mini-garden or container growing. CQ
NCX 300	FC	CM	Spring only, 75 days. CQ
Packer*	PS	H,CM	Mid-season, medium large heads.
79-60	BA	H,CM	Early. SS
BRUSSELS SPROUTS			
Craton*			Early, medium-tall, firm smooth.
Crenel*			Early, tall, very vigorous, sturdy.
Fortress*	U	CM	Late, tall, firm dark green. CQ
Lunet*	R,SS	CM	Firm dark green. Medium late. CQ
Merlon*			Mid-early. Rot resistance.

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
BRUSSELS SPROUTS (continued)			
Predora*	U	H,CM	Early, medium tall. CQ
Rampart*			Late, tall, large sprouts.
SG 651*			Mid-early, round and smooth.
Valiant	R	CM	Medium early, medium green sprouts.
CABBAGE			
Ace	U	H	AAS, semi-globe savoy, 4-4½ lbs. CQ
Blueboy*	T,AC	CM	Deep blue green, YR. CQ
Celsa*	U	H,CM	Small, round. CQ
Early Dawn*	FC	H,CM	Blue-green. CQ
Enterprise*	A	H,CM	Yellows resistant. SS & CQ
Exp. 916*	NK	CM	CQ
Exp. Hyb. 9844	K	H,CM	Blue-green, uniform maturity. CQ
Green Delight*	K,U	CM	Extra early, bright green, compact.
Harvester Queen*	NK	CM	CQ
Ice Prince	SS	H,CM	Savoy, dark green, 4 lbs. CQ
Jade Pagoda*	P	H,CM	Good vigor, fine quality.
Minicole	U	H	Small, round to oval. CQ
Regal*	K,U	H	Resistant to black speck.
Safekeeper*	SS	CM	Green Winter type. No YT. CQ
SG 617*			Multipurpose, stands well.
Super slaw	SS	CM	Heavy, round solid heads. CQ
Superpack*	R	CM	Blue-green, medium size heads.
Tastie*	SS	H,CM	Round heads 3-5 lbs., 68 days. CQ
Taurus			Very short core, early autumn white.
Vela*	R,U	H,CM	Extremely early, very compact, 2 lbs.
CARROTS			
Amstel	SS	H	Miniature, smooth, 54 days. CQ
Baby Orange	SS	H	Miniature, smooth, 53 days. CQ
Dandy*	FC	CM	Hicolor. Danvers type. CQ
Gold Pak 263	A	CM	Long, slender, smooth roots; CQ
Impak*	FC	CM	Hicolor Imperator. CQ
No. 8528T*	R	CM	Imperator type, good color, smooth.
Orange Sherbet*	SS	H	Nantes x Imperator. Smooth, 10". CQ
Scarlet Keeper	JS	H	Late, fall harvest, storage 7-8 weeks.
Sierra* (490)	NK	H	CQ
Tahoe* (462B)	NK	CM	CQ
CAULIFLOWER			
Alert	SS	H,CM	Early, 54 days, excellent quality. CQ
Alpha Paloma			Snowball A type. Deep white curd.
Delira	R,SS	H,CM	Autumn type. Self-wrapping. SS
Danova	U	H,CM	Large, heavy well protected heads. CQ
Nimba	U	H,CM	Late autumn crop, vigorous growth.

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
CAULIFLOWER (continued)			
78-802,78-908, 79-882,79-832	MSU	CM	Early, heat tolerant, upright leaves.
SG 105			Uniform, short cutting period.
Snowbird	SS	H,CM	Early, 58 days. CQ
Starlight*			Mid-early, large deep heads.
Stovepipe (817)	MSU	H,CM	Early, good curd quality. SS
Suprimar			Snowball Y type. Deep rowed curd.
White Empress (MSU 812)	H	H,CM	Earlier than Self Blanche. CQ
White Summer	SS	H,CM	Self-wrapping, large heads. CQ
CUCUMBER			
Bush Champion	BUR	H,CM	Compact, slicer; mosaic resistant.
Calico	NCSU	CM	Pickling, gynoecious.
Calypso	H	CM	Disease resistant pickle. CQ
Castlex 2504*	C	CM	Burpless, 64 days, DMT, PMT.
Clinton	NCSU	CM	Pickling, monoecious, late.
Daleva*			Gynoecious; scab, leaf spot resis.
Dasher*	HO,PS,SS	H,CM	Slicer, 46 days, dis. resis. CQ
Exp. Hybs. 2602,2603, 2604,2605 2606,2607	K	H,CM	Gynoecious white spined pickler. SS
Exp. Hyb. 2608	K	H,CM	Gynoecious black spined pickler. SS
Fembaby	SS	H,CM	Greenhouse type, 10" fruits. CQ
Farbiola	SS	H,CM	Greenhouse type. Fruits 16-17". CQ
G-29	NCSU	CM	Pickling, gynoecious.
G-30	NCSU	CM	Pickling, gynoecious.
Green Bowl*	KY	H,CM	Slicer, mosaic,mildew resis. burpless.CQ
Hyslice*	C	CM	Slicer, early, dark green; gynoecious.
Lucky Strike*	HO,GM	H,CM	Gynoecious; dis. resis. CQ
Marketmore 76	AG,C,SS,H	CM	Marketmore 70 with improved dis. resis. CQ
Marketmore 80	CO	CM	Bitter free slicer. SS
NCX 5504	FC	CM	Scab resis., CMVR, early. SS
Poinsett 76	H,C,SS	H,CM	Mildew, scab tolerance, 65 days. CQ
Roadside Fancy*	AG	CM	Long, slender, 8½", dis. tolerant.
Saladin*	BA,SS,R	H,CM	AAS, pickle, 55 days. Dis. resis. CQ
SG 891		CM	Gynoecious, dark green, white spined.
Southern Belle	NCSU	CM	Pickling, gynoecious.
Southernsett	H	CM	Pacer type, mildew resistance. CQ
Spiffy*	K	H,CM	Gynoecious, black spined pickle. CQ
Sprint 440N*	A	H,CM	Early slicer, dis. resis. CQ
Superator	SS	CM	Greenhouse type. Fruits 12-15". CQ
Swallow	KY	H,CM	Early, slim, burpless. CQ
Tempo (C589)	H	CM	Pickle. CQ
Tripleneck 88*	LE	CM	Compact.
Triple Pak	FC	CM	White spine pickle; gynoecious. CQ

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
EGGPLANT			
Black Bell	PS,SS,P	H,CM	Round, dark purple, 60 days. CQ
Black Pride	FC	CM	Florida type. Very early. VWT. CQ
Black Prince*	U	H,CM	Early; long, dark purple fruit. CQ
Easter Egg	BA	H,CM	White egg shaped fruit. CQ
Imperial or French Imperial	PS,SS	CM	Italian type, 61 days. CQ
KALE			
Fribor*	U	H,CM	Fall crop, finely curled leaves. CQ
KOHLRABI			
Grand Duke*	SS,T,BUR	H,CM	AAS, 50 days, tol. to black rot. CQ
LETTUCE			
Capitan	SS	H,CM	Greenhouse, large Boston,62 days. CQ
Citation	A	H,CM	Slow bolting, loose leaf. SS & CQ
Cosmo	K	CM	Early cos type.
Crispy Sweet	P	H,CM	Loose leaf. CQ
Darka	U	H,CM	Large, solid. Slow to bolt. CQ
Deep Red	H	CM	Tinged leaf type.
Domineer	SS	H,CM	Standard leaf type; 40 days. CQ
Empress	FM	CM	Iceberg type, heavy head.
Green Lakes	H,J	CM	Produce in hot weather. CQ
Irma	U	H,CM	Heavy head, slow to bolt. CQ
Montello	H	CM	Head lettuce.
MSU 1044	MSU	CM	Bibb type, early.
Orfeo			Slow bolting, heavy head.
Rigoletto			Heavy, firm, light to medium green.
Summer Queen	A	H,CM	Slow bolting, butterhead.
Sweetie	P	H	Semi-cos type; early and high yield.
Tanya	H	H,CM	Improved white Boston. CQ
Vanguard 75		CM	Mosaic resistant. CQ
Windemere	U	H,CM	Small crisp-head type. CQ
MUSKMELON			
Alaska*	PS	H,CM	Large, early. CQ
Cameo*	K	H	Medium-early, crystal white interior.
Castlex 5003*	C	H,CM	Oval-round; thick, small cavity. SS
Dixie Jumbo*	T,PS	H,CM	Early, good disease resistance. CQ
GQM9	H	CM	Monoecious, medium to large; early. FWR
GQVW	H	H,CM	Monoecious, medium size, FWR.
G25VB	H	H,CM	Large, late, oval to oblong, FWR
Honeydew Pineapple*	P	H,CM	Green flesh, early; exotic flavor. CQ
IPC	CO	CM	PMR, FWR; like Gold Star. SS
MRM9	H	CM	Large monoecious Gold Star type. FWR
Mainstream	SC	CM	Compact vine, 2½-3 pounds; PMR,DMR. SS

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
MUSKMELON (continued)			
Milky Way	KY	H,CM	Early, honeydew type, green flesh. CQ
Minnesota Honey	GU	H	Earlier and similar to Iroquois.
Morgan	FC	CM	Univ. of Fla. Honeydew. CQ
PMR 45 Improved	M	CM	PMR. 36 size deep orange flesh.
PCNBV	H	CM	Large Gold Star type.
Roadside*	T,PS	H,CM	Very large, up to 10 lbs. CQ
Summet*	A	H,CM	Thick and firm, small seed cavity. CQ
Swan	KY	H,CM	Early; small-fruit, white fleshed. CQ
Top Net	M	CM	No ribs, full net; high soluble solids.
U.C. Honeyloupe	UC	H,CM	Andromonoecious. Crown blight and VWR, 3 to 6 pounds. Small cavity. SS
Zenith*	K	H	Well netted, salmon orange flesh.
OKRA			
Candleabra Branching	P	H	Compact, branching base habit.
ONION			
ABCO*	AC	H,CM	Long day, storage; medium large. CQ
Enterprise	SS	H,CM	Storage, hard, medium-sized bulbs. CQ
Gladiator*	K	CM	Medium size yellow globe, pungent. CQ
Mirage	SS	H,CM	Early, storage. Dark outer skin. CQ
NCX 1008*	FC	CM	Spanish, high yield. SS
Rialto*	A	CM	Large, early; some pink root tolerance.
Saturn*	PS	CM	Mid-day length, yellow globe; stores. CQ
SG 903		CM	Deep global shape; Sweet Spanish type.
Surecrop*	H	CM	Storage type.
Tamarack	SS	H,CM	Extra early, long term storage. CQ
Taurus*	A	H,CM	Midseason storage type. SS & CQ
Walla Walla Street	NI		Large, fragrant, mild, cold hardy.
PEAS			
Dot	R	H	High yielding, smooth round type.
Green Arrow	SS,K,BUR	CM	Small, 9-11 peas/pod. FWR, DMR. CQ
Kriter	A	CM	Alaska type, early smooth, FWR. CQ
Knight	H,R	CM	Multi-dis. resis., 61 days. CQ
Maestro	BUR	H,CM	Medium height, long podded; 61 days. CQ
Novella	R	H,CM	Semi-leafless, midseason.
Sugar Snap*	BUR,P,H	H,CM	AAS, edible-podded snap pea. CQ
PEPPER			
Big Bertha*	GU,BA,PS	H,CM	Large, long, thick wall, TMVR. CQ
Cadice		CM	
Fire	BA	H,CM	Hot, 1 3/4-2 inches. CQ
Gold Spike	U,PS	H,CM	Yellow, 3" long, hot. CQ
Hades Hot	SS	H	Ornamental, 75 days, 4" fruit. CQ
Holiday Time		H	Ornamental edible, hot.

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
PEPPER (continued)			
Hybelle*	H	CM	Good performance, TMVR.
Market Master*	G	CM	Large, blocky, heavy walls, TMVR. CQ
NCX 4013	FC	CM	Very dark green, blocky. SS
Naples	SS	H,CM	Tapered, Italian sweet 7" long. CQ
Park's Whopper*	P	H,CM	Blocky, 4 lobed, 65 days. CQ
Pot Luck		H	Hanging basket, 6-7" fruit.
Resistant Giant #4	PS	CM	TMVT; Green to red thick walls. CQ
75	BA	H	Small, sweet banana. SS
Super Rattail Hot	SS	H,CM	Hot, pencil thin, 5", 66 days. CQ
Superset	SS	H,CM	Extra early, 4" x 5" blocky. CQ
Sweet Banana*	P,H,T	H,CM	Extra vigor, thick flesh. CQ
Tequila Sunrise	P	H	Ornamental edible, orange. CQ
Valley Giant	G	CM	Mid-season, thick walled 3-4 lobe.
POTATO			
Butte	IC	H,CM	Smooth, easy to grow. CQ
Delta Gold	UME	CM	Yellow flesh, uniform, high solids, superior baking,medium-late, round smooth.
New York 61	CO	CM	Golden nematode resis. red markings in eyes. (NA)
PUMPKIN			
Big Moon	T,PS	H	Pink-orange, up to 200 pounds. CQ
Little Boo	AG	H,CM	White variety for hand painted faces.
RADISH			
Fancy Red	H	CM	Red, multiple dis. resis. CQ
Inca	R	H,CM	Round, red, medium top, very firm. CQ
Red Baron (NK1)	NK	CM	CQ
Saxafire	SS	CM	Red, oval. 21 days. Clubroot tol. CQ
SPINACH			
Estivato	R	H,CM	Large, Savoy type; late.
Kent*	A	H,CM	Large, savoy leaves. CQ
Indian Summer*	R	H,CM	Semi-savoy, slow bolting, summer crop.
Palona*			Early, fall and spring sowing.
7241	K	H,CM	Slow bolting, smooth texture. CQ
Symphony*	R	CM	Vigorous, medium early.
SQUASH (SUMMER)			
Apple Squash	S,TM	H	Round, 60 days, zucchini type.
Blue Heaven	SS,S	CM	Yellows tolerance; blue green.
Castle Pride	S,C	H,CM	Early, yellow crookneck, smooth. SS
Crookette*	FC	CM	Yellow, slim neck crookneck. CQ
Dixie*	A	H,CM	Crookneck. SS and CQ

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
SQUASH (SUMMER) - (continued)			
Genie*	FC	CM	Medium-green zucchini. CQ
Gold Rush*	SS,PS,BA	H,CM	Yellow smooth, straight 4-8". AAS, CQ
Gourmet Globe*	G,P	H,CM	Round striped zucchini. CQ
Grey Tezierprime	S,U	H,CM	Early, spotted grey-green zucchini. CQ
Ingot*	K	H,CM	Yellow straightneck. C,
Market King*	S,K,U	H,CM	Zucchini, small plant.
Milano	S,AG	H,CM	Zucchini, upright; early set.
Moneymaker*	S,K	H,CM	Crookneck, smooth, tender. CQ
Napolini*	FC	CM	Fresh or processing zucchini. CQ
Park's Green Whopper*	P	H,CM	Cylindrical zucchini, 48 days.
Scallopini*	GE,PS,U,BUR	CM	AAS, 50 days, globe shape. CQ
Storrs Green	S,U	H	Early, zucchini.
Sundance	T,BA,SS	CM	Yellow crookneck, 52 days. CQ
SQUASH (WINTER)			
Butterboy*	BUR	H,CM	Short vined Butternut type. CQ
Early Butternut*	T,BA,PS	CM	AAS, early semi-bush habit, thick neck. CQ
Seneca Butterbar*	BUR	CM	Cylindrical, 51 days. CQ
Sweet Mama*	T,BUR	CM	AAS; FW, squash borer tolerant. CQ
Table Ace*	BUR,PS,J	CM	Dark acorn, 78 days, semi-bush type. CQ
SWEET CORN			
Apache*	A	H,CM	Well filled, uniform size; 81 days.
Atlantic*	FC	CM	Big ears, 90 days. CQ.
Bellgold*	H	CM	Early midseason. CQ
Burgundy Delight*	S,SS	H,CM	Bicolor ears, 73 days; 7-8" long. CQ
Calico*	A	H,CM	Bicolor, tender and sweet. CQ
Calypso*	R	H,CM	Bicolor, midseason, well filled ears.
Candyman*	K,U	CM	Slow conversion, 14-18 rows.
Candystick*	P	H,CM	Slim, long, tiny cob, 70 days. CQ
Candystick II	BUR	H,CM	Long slender ears with pencil cob. CQ
Carmelet*	S	H,CM	Good tip fill, 72 days; 8-9" ears. SS & CQ
CrYW 7601*		CM	Early bicolor.
Earliqueen*	R	H,CM	Early-main season, 7" white ears. CQ
Early Gold*	FC	CM	Processing or fresh, 75 days. CQ
Early Gold & Silver*	SS	H,CM	Bicolor, 62 days, 8!" ears. CQ
Early Sunglow*	MSU	H,CM	Early, 68 days, yellow 6!-7" ears. CQ
Enterprise*		CM	Early midseason, attractive.
Golden Gleam*	H	CM	Field tolerance to MDMV, 90 days. CQ
Golden Sweet EH*	HE,SS	H,CM	88 days, 10-14 day picking. CQ
Guardian	A	H,CM	Large tapering ear; 80 days. CQ
Intrepid*		CM	Early yellow.
Iosweet EH*	HE	H,CM	No isolation, 91 days.

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
SWEET CORN (continued)			
Kandy Korn EH*	MU,HF,SS	CM	Yellow, 89 days. CQ
Kelvedon Sweetheart*	U	H	Early, long.
Lancer*	S	CM	Deep kernels, 80 days, 8" ear. SS & CQ
Lightnin'*	AC	H,CM	White, 87 days, well flagged. CQ
Mainliner EH*	MU,HE,BUR	H,CM	Extra sweet, 92 days. CQ
Northern Sweet*	AG,SS	H,CM	Super sweet, 63 days, 7" ears. CQ
Patriot*	R	H,CM	Full season; well filled large ear.
Peaches & Cream*	MU	H,CM	Bicolor, 78 days. 8" ears. CQ
Pennfresh ADX*	AG	CM	Slow conversion, yellow; 88 days, 8" length, isolate.
Platinum Lady*	SS	CM	White, 8" ears, early-main season. CQ
Quicksilver*	H	CM	White, excellent quality, 75 days. CQ
Ruby Gem*	S	H,CM	Early, bicolor.
Seneca Pathfinder*	RS	H,CM	Fine quality, 64 days.
Seneca Pinto*	RS	H	Bicolor, 85 days; 8-8!" long.
Seneca RXP 214*	RS	H	Yellow MDMVT, 89 days; 8-8!" ears.
Seneca Raider*	R	H,CM	Well filled, small kernels; 77 days
Seneca Star*	R,SS	CM	Vigorous, 66 days, 7-8" ears. CQ
Silver Dollar*		CM	Early midseason, white.
Silver Treat*	SS	CM	Tillerless, well flavored; 12-14 rows. CQ
Slendergem*	S	H,CM	Yellow 8-9" ears, 76 days. SS & CQ
Snow Cap*		CM	Early main season, white ears 8".
Synergistic Intrepid*		CM	High sugar, yellow.
Synergistic Bl Lightning*		CM	High sugar, bicolor.
Tendertreat EH*	MU	H,CM	Light gold, 95 days, 9" ears. CQ
Twil-Sweet*	T	CM	Early, white, 8" ears, 16 rows. CQ
White Lightning*	SS,C	H,CM	Earlier than Silver Queen. MDMVT. CQ
White Sunglow*	MU,BUR,SS	H,CM	Early, 65 days, high quality white. CQ
SWEET POTATOES			
Caromex	NCSU	CM	Yam-type, dark copper skin, deep orange flesh, stores well; FWR. SS
TOMATOES			
Blazer*	FC	CM	Main season, med. oblate fruits. CQ
Calypso	PS	H,CM	Determinate, early, VF tol., smooth. CQ
Casino Royale*	FM	CM	Staked, heavy foliage, FWR. CQ
Castle 1606	C	CM	Jointless, firm, crack resis.
Castlehy 105*	C	CM	Indeterminate, firm; VF.
Castlex 1014	C	CM	Medium-large fruit, VFR.
Early Cascade	PS,SS,BA,BUR	H,CM	Staked, medium size, early indet. CQ
Early Girl*	BA	H,CM	Continuous fruiting, medium size.
FMC 3032	FC	CM	Processing, heavy production. CQ

Variety or hybrid	Company	Principal use for Illinois H = Home garden CM = Commercial market	Brief descriptive notes
TOMATOES (continued)			
Freedom*	AC	CM	Globe shape, jointless stems. CQ
Full House*	FM	CM	Large fruit, firm. CQ
Goldie	P	H	Yellow 1" dwarf fruit, 14 inch plant.
Hybrid #39	FM	CM	Medium early, large, staking, VFN.
Hyb. 79-748	G	H	Early, pole, medium fruit, VFN, TMVR.
Hyb. 79-874	G	H	Pole type, large fruit, VFN, TMVR.
MSU-199	MSU	H,CM	Jointless, early to midseason, cherry type.
Ohio 7663	G	H	Oval 2.5 oz; determinate, FWR. CQ
Oregon Cherry	O	H	Determinate, similar to Small Fry. SS
Patio Prize*	G	H	Bush type, medium size fruit. CQ
Perfect Peel	G	H	Bush type, fruit peels easily; VF.
Pole King*	AC	CM	Large, firm fruit; VF, indeterminate. CQ
Roadside Red*	AG	H,CM	Indeterminate, globe shape, VF, 5-6 oz.
Oregon T5-4	O	H	Parthenocarpic, good flavor. SS
Supersteak Hyb.	BUR	H,CM	Beefsteak type, VFN. CQ
Tempo*	A	CM	Medium to large, flattened globe. CQ
Whippersnapper	JS	H	Compact cherry, 52 days, 1" oval fruit.
TURNIP			
Short Top	LE	H	Short top turnip 16-18".
WATERMELON			
Blue Belle*	A	CM	Round, dark green. CQ
Big Bully			79 days, 15+ pounds.
Charleston 76	FC	CM	Blocky for shipping CQ
Grand Baby	KY	H,CM	Sugar Baby type. CQ
Honey Island	TM	H	Cold tolerant; yellow flesh, 6 pounds.
Improved Tri x 313*		H,CM	Seedless, 16-18 pounds.
NCX 1553	FC	H,CM	Fusarium resistance. SS
New Dragon	KY	H,CM	Early, Blue Ribbon type. CQ
Panonia	SS,FM	CM	Sugar Baby type.
Polycross #1*	AS	CM	Seedless, improved fusarium and anthracnose resis., 18-20 pounds. SS
Seedless Sweety*	P	H	Triploid, 8 lbs. Sugar Baby pollinator.
Yellow Doll*	HE,GM	H	Yellow, 5-8 pounds, 73 days. CQ.

Abbreviations used in variety descriptions:

AAS	= All America Selection	PM	= Powdery mildew
BYMV	= Bean yellows mosaic virus	PEMV	= Pea enation mosaic virus
CMV	= Cucumber mosaic virus	Resis., R	= Resistant
CQ	= Commercial quantity	SS	= Trial sample
Dis.	= Disease	Syn.	= Synergistic Sweet
DM	= Downy mildew	T	= Tolerant
FW	= Fusarium wilt	TMV	= Tobacco mosaic virus
Gyn.	= Gynoecious	VFN	= Verticillium, Fusarium, Nematode
MDMV	= Maize dwarf mosaic virus	VW	= Verticillium wilt
NA	= Not available	Y	= Yellows

Herbicide Guide 1980

FOR COMMERCIAL VEGETABLE GROWERS

Restricted-use herbicides are identified with an asterisk (*).
You must be certified as a pesticide applicator to use restricted-use pesticides.
See your county Extension adviser in agriculture for information.

WEED GROWTH reduces the income of vegetable growers in the United States by millions of dollars annually as a result of lower yields, poorer quality, and added labor in harvesting and processing.

This guide should be used together with the grower's knowledge of soil types and the crop and weed history of the area to be treated. Whether to use herbicides or other means of weed control depends in part on the severity of past weed infestations. In many instances mechanical control is sufficient, or it may be needed in addition to herbicide use. Several herbicides may be suggested for some crops. These herbicides have shown good control with no injury to the vegetables under test conditions. Not all herbicides cleared for use on a species are necessarily listed. Where the choice of more than one herbicide is suggested, the decision rests with the grower and is based on his knowledge of past weed infestations, crop rotations, and material costs. Where one herbicide will not control the weeds present, a combination of herbicides may be suggested. When using a herbicide for the first time, use a small-scale trial.

These suggestions for chemical weed control in vegetables are based on research at the Illinois Agricultural Experiment Station, the U.S. Department of Agriculture, and other research institutions. The University of Illinois and its agents assume no responsibility for results from the use of these herbicides, whether or not they were used in accordance with suggestions, recommendations, or directions of the manufacturer or any governmental agency.

Reading the label of the herbicide container is tl most profitable time you spend in weed control. U of the material and methods of application and use d pend on registration of the herbicide by federal ar state Environmental Protection Agencies (EPA). D not use any herbicide *unless the label states that it cleared for the use on the crop to be treated.*

Herbicides are being classified for *general use* or *re stricted use* by the U.S. Environmental Protectio Agency. A person wishing to use a herbicide classifie for restricted use must be certified as a private or com mercial pesticide applicator by the Illinois Departmen of Agriculture. Contact your county Extension advise in agriculture for details about this program.

Only a few herbicides have been classified at this tim More will be classified later.

Where mixtures of chemicals are applied, the *use* will assume the responsibility for freedom from res dues if such applications are not labeled by the EPA as a mixture.

Suggestions sometimes change during the growin season, based on EPA clearances that were made afte this circular was issued. This publication, printed onc a year, is subject to change without notification.

Watch for notice of changes in the EPA registratio of herbicides (as released by the EPA) in the *Illinoi Vegetable Farmer's Letter.* A subscription form for thi University of Illinois newsletter is available from th Agricultural Newsletter Service, 116 Mumford Hal Urbana, Illinois 61801.

NOTE: In the suggestions given on the following pages, the trade names of the herbicides are usually used. The list below shows trade names and their corresponding common names.

Common name	Trade name	Common name	Trade name	Common name	Trade nam
alachlor	Lasso	dalapon	Basfapon, Dowpon	naptalam	Alana
atrazine	AAtrex and others	DCPA	Dacthal	nitrofen	TOI
benefin	Balan	dinitramine	Cobex	paraquat*	Paraquat
bensulide	Prefar	dinoseb	Premerge-3, Sinox	phenmedipham	Betana
bentazon	Basagran	diphenamid	Dymid, Enide	profluralin	Tolbai
butylate	Sutan+	diuron	Karmex	pronamide	Keri
CDAA	Randox	EPTC	Eptam, Eradicane	propachlor	Bexton, Ramro
chloramben	Amiben, Vegiben 2E	glyphosate	Roundup	pyrazon	Pyramii
chlorbromuron	Maloran	linuron	Lorox	simazine	Princej
chlorpropham	Furloe	MCPA, MCPB	(numerous ones)	trifluralin	Treflai
cyanazine	Bladex	metribuzin	Lexone, Sencor	Petroleum solvent	Stoddard Solven
cycloate	Ro-Neet	napropamide	Devrinol	2,4-D (amine)	(numerous ones)

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
Prepared by H. J. Hopen, Department of Horticulture (revised annually) CIRCULAR 907 (October, 1979)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
...rgus ...gs)	Amiben	3 lb.	Annuals	Immediately after seeding	Irrigation or rainfall after treatment will give maximum control.
...rgus ...shed ...gs)	dalapon	5-10 lb.	Perennial grass	End of harvest season following disking	Apply when grass weeds are 3 to 4 inches tall. Direct spray under fern growth. Use surfactant as directed on label.
	Karmex	1-4 lb.	Annuals	In spring and/or after harvest	Apply after disking. Do not exceed 6 pounds per growing season. Use a lighter rate on sandy soil. With Karmex and Princep, a spring application may be sufficient after the first year.
	Princep	3-4 lb.	Annuals	In spring and/or after harvest	Apply after disking. Do not treat during the last year in asparagus because of residue.
	metribuzin	1-2 lb.	Primarily broadleaf weeds	Early spring before the spears emerge	Apply after disking. Do not apply within 14 days of harvest. Can help control broadleaf weeds when used with dalapon, Karmex, or Princep.
	Perennial weed control, applications during and outside the growing season (see page 6)				
	Stale seedbed, before crop emergence (see page 5)				
	Preemergence				
...dry, ...nd snap	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Plant crop immediately, or within 3 weeks after application Can be used up to 1 pound per acre on dry beans.
	Tolban	0.5-1 lb.	Primarily annual grasses	Preplant soil incorporation	
	Premerge-3	6-7.5 lb.	Annuals	Can be used between planting and crop emergence	Do not use on light, sandy soil. Some stand reduction may result from use. See label for precautions.
	Postemergence				
	Basagran	0.75-1 lb.	Annual broadleaf weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after the first trifoliate leaf appears on beans	Can provide good, broad-spectrum control when combined with a grass-active herbicide. Do not mix with other pesticides. See Basagran entry under corn, postemergence for Canada thistle and nutgrass control.
	Perennial grass control, applications outside the growing season (see page 5)				
..., lima ...y	Amiben	2-3 lb.	Broad spectrum of annual weeds	Immediately after seeding, or preplant-incorporated for lima beans	Field may be rotary-hoed without destroying herbicide action.
..., snap	Eptam	3 lb.	Annual grasses and nutgrass[3]	Preplant soil application, incorporate with soil immediately	
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	Do not feed treated plant parts to livestock.
	Vegiben 2E (2E form *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	Use on loam soil.
...s, dry	Cobex	0.3-0.6 lb.	Annuals	Preplant soil incorporation	
..., garden	Pyramin	4 lb.	Annuals (primarily broadleaved)	Preemergence or after beets emerge and before weeds have two true leaves	Rainfall or irrigation needed to activate. Where grasses are a severe problem, use 4 pounds of Pyramin plus 4 pounds of Ro-Neet.
	Ro-Neet	4 lb.	Annual grasses	Preplant soil application, incorporate with soil immediately	Use a combination treatment with Pyramin to broaden control spectrum.
	Betanal	1-1.5 lb.	Broad spectrum of annual weeds. Not effective on pigweeds	After the beets are past the 2-true-leaf stage	Beets in the cotyledonary stage may be severely injured. For best results, spray when the weeds are between the cotyledonary and 2-true-leaf stage. Best results will be obtained when the weeds are actively growing and are not under water or heat stress. Do not apply later than 50 days before harvest. May injure beets under heat, water, or other environmental stress.
	Preemergence — direct-seeded or transplanted				
...coli ...sels ...ts	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Stunting or growth reduction may occur at recommended rates under growth stress conditions. Can be used up to 1 pound per acre on transplants.
...age ...flower	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding. Can also be incorporated preplant	
	Postemergence — direct-seeded or transplanted				
	TOK[5]	3-6 lb.	Broadleaved weeds[6]	One to two weeks after crop emergence or transplanting, while weeds are in seedling stage	Use wettable-powder formulation to reduce injury potential. Use in combination with preplant or preemergence material for annual grass control.
	Preemergence				
...ots	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Seed after application to 3 weeks later.
	Postemergence				
	Lorox	0.75-1.5 lb.	Annuals	Postemergence on carrots only after the crop is 3 inches tall; grasses, less than 2 inches; broadleaves, less than 6 inches	Do not feed treated foliage to livestock or replant treated area for 4 months. More than one application may be made, but do not exceed a total of 2 pounds per acre. Do not use over 40 PSI. Use no surfactants when temperatures exceed 80°F., or crop injury may result.
	TOK	3-6 lb.	Broadleaved weeds[6]	While weeds are in the seedling stage	Can also be used on celery and parsley. Use in combination with preplant or preemergence material for annual grass control.

...ued on the next page.

...footnotes on page 105.)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Carrots (cont.)	Stoddard Solvent	60-80 gal.	Annuals	After two true leaves have appeared (do not apply to carrots or parsnips after they are ¼ inch in diameter, since an oily taste may result)	Most effective when sprayed on cloudy days or durin humidity, and when weeds are not more than 2 inche May not control ragweed. Do not apply within 40 d harvest. Can be used on celery, dill, parsnips, and pa
Corn, pop	**Preemergence**				
	atrazine	2-3 lb.	(See sweet corn)	(See sweet corn)	See sweet corn, *except the section on preemergence combin*
	Bladex	(See remarks)	Annuals	Preemergence only	Some pop corn varieties are sensitive to the applic rate. (See remarks on Bladex under sweet corn.)
	Princep	2-3 lb.	Annuals	Preemergence	Plant only crops so specified on the label the following Do not graze treated areas.
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	See sweet corn.
	Sutan+	3-4 lb.	Primarily annual grasses	Preplant soil application, incorporate with soil	See sweet corn.
	Postemergence				
	2,4-D	0.5 lb.	Broadleaved weeds	Postemergence	Apply when corn is 3 to 10 inches tall.
	Perennial grass control, applications outside the growing season (see page 5)				
Corn, sweet	**Preemergence**				
	atrazine	2-3 lb.	Annuals, annual and perennial grasses[7]	Preemergence, apply no later than 3 weeks after seeding. Shallow cultivation may improve weed control during dry weather.	Grow corn a second year without atrazine treatment. chemical has a high soil residue. Do not plant other table crops on a sprayed area until a second year of cor been grown. Use atrazine where quackgrass is a pro Residue hazard decreased when banded or in combin with Lasso, propachlor, or Sutan.
	Bladex	(See remarks)	Annuals	Preemergence only	Some sweet corn varieties are sensitive to the applic rate. Has been shown to have less soil residual than atr. See label for rates and precautions. Do not use post gence, or on sandy or loamy-sandy soils (under 1 pe organic matter). Can be combined with other herbici reduce the rate being used. NOTE: The Shell Che Co. has a bulletin on using Bladex on pop and sweet
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	Use to control weeds that are difficult to control with herbicides, such as wild cane, nutsedge, quackgrass seedling Johnsongrass.
	Lasso	2-2.5 lb.	Annuals	Preemergence	Preplant incorporation may aid control of nutgrass.
	propachlor	4-5 lb.	Annuals	Preemergence	Do *not* use on sandy soils. Is an excellent herbicide or with a high organic-matter content.
	Sutan +	3-4 lb.	Primarily annual grasses	Preplant soil application, incorporate with soil	Especially useful on sandy soil and where nutgras problem.
	Preemergence combinations				
	atrazine plus Lasso	1.5 lb. +2 lb.	Annuals and perennial grasses	Preemergence or preplant incorporated	See label for slightly higher rate of Lasso for preplan corporation.
	atrazine plus propachlor	1.5 lb. +3 lb.	Annuals and perennial grasses	Preemergence	Use to reduce atrazine residue.
	atrazine plus Sutan +	1 lb. +3-4 lb.	Annuals and perennial grasses	Preplant soil incorporation, incorporate with soil immediately	Use where nutgrass is a problem and to reduce atr residue.
	Postemergence				
	2,4-D (amine)	0.5 lb.	Broadleaved weeds	Postemergence	Preferably, apply before corn is 6 inches tall. If corn is 12 inches, reduce the rate to ¼ pound.
	atrazine	2 lb.	Annuals, annual and perennial grasses[7]	Directed spray 3 weeks after emergence	Can be combined with crop oils for postemergence app tion as an emergency measure. This may increase residu following year. Preemergence use preferred. Do not or feed treated foliage for 21 days after treatment.
	Basagran	0.75-1 lb.	Broadleaved annual weeds, Canada thistle, and nutsedge	Early postemergence when the weeds are small and actively growing. Delay will result in less control.	For Canada thistle and nutsedge, split applications preferred. Make the first one when the plants are 6 inches tall; for nutsedge, 7 to 10 days later; for Ca thistle, 10 to 14 days later (or use one application cultivation). Do not mix with other pesticides.
	Perennial grass control, applications outside the growing season (see page 5)				
Cucumbers Muskmelons Watermelons	Alanap[8]	3-5 lb.	Annuals[3]	Immediately after seeding or transplanting	Do not use on cold soil. Rainfall or irrigation after t ment gives maximum control.
		3-3.5 lb.		After transplanting or vining	Use the granular form. Keep away from foliage. App soil after the weeds have been removed.
	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Is primarily a grasskiller. Consult label for sensitive c within 18 months after application. Prefar can be use rotation with tomatoes, broccoli, cauliflower, lett carrots, onions, and summer squash within 18 montl
	Prefar plus Alanap[8]	4 lb. +2-3 lb.	Grasses and broadleaved weeds	Preplant soil incorporation for Prefar; Alanap, as an immediate postseeding application	Has value for broad-spectrum weed control. Consult l for sensitive crops within 18 months after Prefar app tion. Has EPA approval as a tank mixture.
	Vegiben 2E (2E form *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	This ester form of chloramben may leach less readil sandy soils. Above 1.5 to 2 pounds per acre, injury cha increase under moist soil conditions. Some muskmelon tivars may be susceptible to Vegiben injury.

As an alternative to herbicides where earliness is desired, black polyethylene mulch will control annual weeds, conserve moisture, and incr early spring soil temperatures.

(See footnotes on page 105.)

	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
nt	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	After plants are established, 4-6 weeks after transplanting	Cultivate and weed prior to application. Can be applied to plants as part of a uniform soil application.
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	For use on collards, kale, mustard greens, and turnips.
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	For use on collards, kale, mustard greens, and turnip greens.
	Furloe	1-2 lb.	Primarily broad-leaved annuals	Preemergence	For spinach only. Use lower rates in cool, wet weather.
adish	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after transplanting	Use for annual grass control and combine with TOK as an early postemergence treatment for broadleaved weeds.
	TOK[5]	3-6 lb.	Broadleaved weeds[6]	Before weeds are 1 inch high	Will not consistently control weeds over 1 inch tall. Some emerging annual grass may be controlled by this treatment. Lower rate will control seedling purslane.
:	Balan	1.5 lb.	Annuals	Preplant soil incorporation Incorporate with soil immediately	Is primarily a grasskiller. Seed after application to 3 weeks later. Do not plant wheat, barley, rye, grass, onions, oats, beets, or spinach for 12 months after application.
	Kerb	1-2 lb.	Annuals	Preemergence or preplant-incorporated	Do not use when the air temperature exceeds 85° F. Use the lower rates listed on sandy soil. Do not use on peat or muck soils. See label for rotation crops. For best results, rainfall or irrigation is needed 1 to 2 days after application, especially during warm weather.
	Preemergence				
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding or transplanting	May not kill smartweed or common ragweed. Can be used on seeds, sets, or seedlings. Use only on mineral soils. Use lower rates on sandy soils. A double application of Dacthal can be used at seeding, layby, or both. In most situations, the weed spectrum on mineral soils will respond well to a combination of Dacthal preemergence and TOK postemergence.
	Randox	4-6 lb.	Annuals[9] (primarily grasses)	Just before onions emerge	Use on muck soils. Heavy rainfall may reduce stand. Very effective on purslane and pigweed.
	Postemergence				
	TOK	3-4 lb.	Broadleaved weeds	When weeds are in the seedling stage and not over 1 inch high	Use a single application of E.C. or W.P. per growing season. Do not apply E.C. until onions are in the two- to three-leaf stage. *Preemergence* use of TOK with heavy rainfall may reduce stand. Use in combination with preplant or preemergence material for annual grass control.
	Furloe	3-6 lb.	Broadleaved weeds (especially smartweed)	On seeded onions: loop stage or after 3- to 4-leaf stage	In the later sprays, direct at base of onion plant. If more than one application is applied do not exceed 6 pounds per acre for the season. *Use lower rates in cool, wet weather.* Use no later than 30 days before harvest.
	Preemergence				
	propachlor	4-4.9 lb.	Annuals	Preemergence	Do *not* use on sandy soil.
	Treflan	0.5-0.75 lb.	Annuals[2]	Preplant soil incorporation, incorporate with soil immediately	Seed after application to 3 weeks later. Some reduction of growth and stand reduction possible under stress. May suppress some root rot.
	Cobex	0.3-0.5 lb.	Annuals	Preplant soil incorporation	
	Preemergence or Postemergence				
	Premerge-3	0.3-9 lb.	Annuals (primarily broad-leaved weeds)	Preemergence or postemergence	Preemergence use 6 to 9 pounds; postemergence, use 0.3 pound to 1.1 pounds. Apply prior to bloom when peas are 2 to 8 inches tall. See label for further precautions. Preemergence use may help suppress root rot.
	Postemergence				
	Basagran	0.75-1 lb.	Annual broad-leaf weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after peas have 3 pairs of leaves (or 4 nodes)	Can help control Canada thistle. Can provide good, broad-spectrum control when used with a grass-active herbicide. Do not mix with other pesticides. See Basagran entry under corn, postemergence for Canada thistle and nutgrass control.
	MCPB	1 lb.	Broadleaved weeds and Canada thistle	When peas are 3-7 inches tall and no later than 4 nodes prior to pea blossom	May delay maturity 1 to 4 days. Use at least 20 gallons of water per acre. Do not feed vines to livestock.
	MCPA	0.25-0.5 lb.			MCPA is more effective on mustard. MCPB is less injurious to peas.
	Perennial grass control, applications outside the growing season (see page 5)				
es,	Eptam	3-6 lb.	Annual grasses and nutgrass[3]	Drag-off treatment at emergence or preplant soil application Incorporate with soil immediately	Use lower rate on sandy soil.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Drag-off treatment at emergence	Use a light incorporation.

otnotes on page 105.)

Crop	*Treatment*	*Active ingredient per acre actually covered*[1]	*Weeds controlled*	*Timing of application (based on crop stage)*	*Remarks, cautions, limitations*
Potatoes, Irish (cont)	Lorox	0.75-2 lb.	Annuals	Apply prior to potato emergence	Plant tubers at least 2 inches deep. Do not replar area to other crops for 4 months after treatment. jure crop on light, sandy soil. Do not apply ove tubers.
	chlorbromuron	2-3 lb.	Annuals	At very start of potato emergence	May injure crop on light, sandy soil. Do not ha mature potatoes. Do not plant crops other than fi potatoes, or soybeans for 6 months after applyin
	dalapon	7 lb.	Quackgrass	Before plowing in spring; wait 4 days before plowing and planting	Not for fields intended for red-skinned varieties Rose. Do not plant potatoes for 4 weeks. Use si as directed on label.
	metribuzin	0.25-0.5 lb.	Annuals (primarily broadleaved)	Postemergence, following a preemergence grass herbicide	Can be used preemergence also. Do not exceed 1 p acre in a season. Do not apply within 60 days of Do not use on red-skinned or early maturing v rieties. Do not apply in cool, wet weather.
	Lasso	2.5-3 lb.	Annuals	Apply at drag-off	Do not use on sandy soils. Can be used alone or in tion with Lorox or dinoseb.
Potatoes, sweet	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after planting	
	Amiben	3 lb.	Annuals	Immediately after planting	
	Dymid, Enide	4-6 lb.	Annuals	Immediately after transplanting	Do not plant nonapproved crops on treated soil d same season.
Squash Pumpkins	Amiben	3-4 lb.	Annuals	As soon after seeding as possible, or preplant-incorporated	Use on loam soils. Amiben can be applied broa banded over the row in pumpkins.
Squash	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Is primarily a grasskiller. Consult label for sensiti within 18 months after application. Prefar can be rotation only with tomatoes, broccoli, cauliflower, carrots, onions, and summer squash within 18 m application. Use in combination with Alanap as suggested for cuc
Tomatoes, direct-seeded and transplanted	Dymid, Enide	4-6 lb.	Annuals	Preemergence	Do not plant other food crops on treated areas for 6 If used under dry soil conditions, a shallow (1 i corporation as a preplant treatment may impro control. Can also be used on transplanted peppers.
	Devrinol	1-2 lb.	Annuals	Preplant soil incorporated	Can also be used on direct-seeded and transplanted
	metribuzin	0.25-1 lb. (min.-max.)	Primarily broadleaf. Should be used with a grass-active herbicide.	Preplant incorporated. Postemergence, can be broadcast or directed.	Apply with ground equipment to seeded and trans tomatoes. Do not use air-blast or other high-pressu equipment. Do not use on peppers.
		0.25-0 5 lb.		Preplant incorporated, transplant tomatoes	Alone or in a tank-mix combination with Treflan.
		0.25-0.5 lb.		Broadcast spray, established tomatoes	Single or multiple applications. Minimum of 1 between treatments. Direct-seeded plants should h 6 leaves; transplants should show new growth.
		0.5-1 lb.		Directed spray, established tomatoes	Recommended for use in fields with severe weed pr or for fields with hard-to-control weeds.
		(For min.-max. rates)			Do not apply within 7 days of harvest. Do not appl 3 days following periods of cool, wet, or cloudy v otherwise, crop injury may occur. Do not apply t lished tomatoes within 24 hours after the applic other pesticides. Do not tank-mix with other pe except Treflan. Do not apply more than 1 pound per crop season, or more than 1 pound per acre v 35-day period. Allow at least 14 days between appli regardless of the dosage or method used. Do not caps on tomatoes within 7 days before applicatio any time afterward.
Tomatoes and Peppers, transplanted	Amiben	3-4 lb.	Annuals	Wait 3 days after transplanting to apply	Use granular formulation only. Apply to dry foliage to avoid leaf burn. Do not use on sandy soils.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Some reduction of growth may be possible under stress conditions, or if rates are higher than sugge the soil type.
	Stale seedbed, before crop emergence				
Asparagus	Paraquat*	0.5-1 lb.	All emerged green foliage	Before crop emergence; allow maximum weed emergence prior to treatment	Weeds that emerge after treatment will not be con Crop plants that have emerged at application will jured. Do not apply within 18 months of harvest.
	Perennial grass control, applications outside the growing season				
Corn, sweet Corn, pop Peas Edible beans	Roundup	2-3 lb.	(See remarks)	(See remarks)	Use for quackgrass or Johnsongrass control. Ap quackgrass when 6 to 8 inches tall in fall or spring. to Johnsongrass when at least 12 inches tall and a growing. Do not till until 3 to 7 days after applicatio not provide residual weed control. Do not mix, st apply. Roundup spray solutions in galvanized steel lined steel containers (except stainless steel) or spray

(See footnotes on page 105.)

	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
	Perennial weed control, applications during and outside the growing season				
a,s	Roundup	2-5 lb.	(See remarks)	Before emergence, after complete spear removal, and with shielded or directed sprays during fern growth	Use to control milkweed, thistle, field bindweed, quackgrass, or Johnsongrass. Apply to quackgrass when it is 6-8 in. tall in the fall or spring. Apply to Johnsongrass when it is at least 12 in. tall and actively growing. Do not till for the specified time for each species (see label). Does not provide residual weed control. Do not mix, store, or apply Roundup spray solutions in containers or spray tanks made of galvanized or unlined steel (except stainless steel).

eon active ingredients (actual amount of active herbicide in material or acid equivalent). Use lower rate on sandy soil and higher rate on clay and loam soils. When nd application over the row, adjust amount of material applied to the part of an acre treated. See Illinois Circular 1047. [2] May not control ragweed and panicum. nt control smartweed. [4] May not control ragweed, smartweed, and velvetleaf. [5] Use of 50% wettable powder is suggested for cabbage and horseradish. [6] May not control chickweed. Grass control is sometimes marginal. [7] May not control crabgrass. [8] Do *not* use Alanap Plus, Solo, Whistle, or Amoco Soybean herbicide. These materials ta Alanap plus another ingredient that may cause injury. [9] May not control smartweed and velvetleaf.

Storing Pesticides and Containers

ep pesticides and containers in a separate building, room, or enclosure used only for this purpose. Such buildings or rooms be dry, ventilated, and locked. Fence outside storage areas to protect children and animals and to discourage pilferage. CAU- Do not store weedkillers, herbicides, or defoliants in the same room with insecticides. Chlorate salts can create a fire or on hazard. Remove only the pesticides needed for one day's operation and return empty containers — and any unused pesti- o the storage area each day.

Disposing of Pesticides and Containers

rplus Pesticides. To dispose of surplus pesticide mixtures, try to find other areas with the same pest problem and use up ra tank mix or rinse water on these areas. Do not drain surplus pesticides in any location where they can contaminate wells, , rivers, lakes, or ponds.

erators of landfills meeting environmental safety standards can obtain supplemental permits to handle toxic waste materials, in- pesticides. To dispose of large quantities of surplus pesticides, contact the Illinois EPA Division of Land Pollution Control e the nearest landfill with a supplemental permit for toxic waste or to obtain specific instructions about disposal.

sticide Containers. All empty pesticide containers, regardless of their type, should be rinsed three times before disposal. ater should be dumped in the tank. Triple-rinsed containers should be punctured or broken to facilitate drainage and to pre- use for any purpose. They should then be hauled to a sanitary landfill for disposal. Small quantities of containers may be buried n open fields, with due regard for the protection of surface and subsurface water.

nois regulations permit the burning of combustible containers provided that they are burned on the premises where they were at they are burned more than 1,000 feet from residential areas, that the burning will not cause undue visibility or environmental , and that no reasonable alternate disposal method is available.

not breathe smoke from burning pesticide containers, and do not burn containers that have weedkillers such as 2,4-D or similar des. When these change to a gas, the vapors may damage nearby crops and shrubbery. Pesticides containing chlorates may ex- hen heated and, therefore, should not be burned.

Other Publications on Weed Control

pies of the following publications on weed control are available from the office of your county Extension adviser in agriculture riting to the Office of Agricultural Publications, 123 Mumford Hall, Urbana, Illinois 61801.

Prevent 2,4-D Injury to Crops and Ornamental Plants — Circular 808
Legal Aspects of Crop Spraying — Circular 990
Calibrating and Adjusting Granular Row Applicators — Circular 1008
Calibrating and Maintaining Spray Equipment — Circular 1038
Controlling Weeds in the Home Garden — Circular 1051
Turfgrass Pest Control — Circular 1076
Herbicides for Commercial Fruit Crops in Illinois — H-659
1980 Field Crops Weed Control Guide

1980 Suggested Fungicide Guide

Fungicide Guide for COMMERCIAL VEGETABLE GROWERS

Vegetable fungicide tolerances and intervals approved by the Food and Drug Administration and the Environmental Protection Agency as of October 1, 1979, are presented in this publication. The tables on pages 2 and 3 give the tolerances in parts per million (ppm) and the number of days between the last application at normal rate and the harvest *or* they give the date of last application that will keep residues within tolerances set by the FDA.

The listing of a chemical for a crop does not necessarily constitute recommendation for control of a disease on that crop by the Illinois Cooperative Extension Service or the Agricultural Experiment Station. Specific recommendations are given on pages 4 to 7.

In some instances a tolerance (ppm) has been set but a definite interval has not been established. The absence of an interval does not necessarily mean that the fungicide may not be used on that crop. Use of the fungicide would require such restrictions as "do not apply after first blooms appear" or "do not apply after edible parts form."

In a few cases the interval and dosage have been established, but the allowable ppm residue has not been determined. Here again this does not mean that the fungicide may not be used on that crop. It does mean, however, that until a tolerance is established it must be considered to be zero. Zero tolerances are reviewed each year. Some are cancelled as the manufacturer supplies the EPA with additional data.

Growers must follow a disease control program that will assure the production of vegetables with no excessive fungicide residues. Vegetables marketed with residues exceeding FDA tolerances may be injurious to consumers, may be confiscated, and may cause the grower to be brought to court.

Growers have nothing to fear from the law so long as they use fungicides and other pesticides according to the current label only on the crops specified, in the amounts specified, and at the times specified. The safe grower keeps a record of the products and trade names used, the percentage of active ingredients, dilutions, rates of application per acre, and dates of application. The record sheet provided on page 8 is a convenient place to keep such information.

This circular is revised each year. Be sure you have the most up-to-date copy.

Prepared by Barry Jacobsen and M. C. Shurtleff, Department of Plant Pathology

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
Urbana, Illinois Circular 999 (revised annually) November, 1979

FUNGICIDE USES FOR VEGETABLES, APPROVED BY THE EPA, OCTOBER 1, 1979[a, b]

Crop	Benlate, 0.2-15 ppm	Captan (D) (See ppm below)	Bravo, 0.1-15 ppm	Di-folatan, 0.1-15 ppm	Dyrene, 10 ppm	maneb, 4-10 ppm maneb with zinc salt	mancozeb[c] (See ppm below)	zineb, 4-25 ppm
sparagus	..	root dip	..	..	..	A[d]	(0.1 ppm), A	A
eans (dry, lima, snap)	14,[e] B (snap only)	(25 ppm), pp, 0[e]	7,[e] B (snap only)	..	..	0[e] 4 on limas or snap	..	7[e]
lima	28							
eet, garden		(2 ppm-root, 100 ppm-greens), 0, pp		..	..	..	..	7(tops)
roccoli	..	(2 ppm), pp	0[e]		..	(10 ppm), 3 or trim and wash	..	7
russels sprouts	..	(2 ppm), pp	0	..	..	7	..	..
abbage	..	(2 ppm), pp	0		..	(10 ppm), 7	..	7
antaloupe (muskmelon)	0	(25 ppm), 0, ph,[d] pp	0	0[e]	0[e]	5	(0 ppm in edible parts), 5[e]	5
arrot	..	(2 ppm), 0	0		..	(7 ppm), 0	(2 ppm) 7, B (tops)	7(tops)
auliflower	..	(2 ppm), pp	0		..	0	..	7
elery	(3 ppm), 7	(50 ppm), 0, pb	7		0	(5 ppm), strip and wash, 14	(5 ppm), 14	strip and wash, 14
hinese cabbage	..	..	..	..	..	..	..	7
orn, sweet and pop	..	(2 ppm), 10, B, pp	14, B[f]	..		..	(0.5 ppm-cob and kernel), 7 (5 ppm-fodder and forage, 0.5 ppm-ears)	0, B, C
ucumber	(1 ppm), 0	(25 ppm), 0, ph, pp	0	0	0	(4 ppm), 5	(4 ppm), 7	5
ggplant	..	(25 ppm), 0, ph, pb	..	..	..	0	..	0
ndive, escarole	..	..	..	..		(10 ppm), 7 and wash	..	10
ennel	..	..		..		..	7	..
ale, collard	..	(2 ppm), pp	..	..	.	(10 ppm), 10 and wash	..	10
ohlrabi	..	..	..	..	..	0	..	(halfgrown)
ettuce	..	(100 ppm), 0	..	..	..	(10 ppm), 7 (strip and wash)	..	10
lustard greens	..	(2 ppm), pp				(10 ppm), 10 and wash	..	10
nion	..	(50 ppm green, 25 dry), 0, ph	0	0	0	(7 ppm), 0	(0.5 ppm dry), 7, D	10
eas	..	(2 ppm), pp	..	..	..	..	..	10, C
epper	..	(25 ppm), 0, pb, pp	..	..	..	(7 ppm), 0	E	0
otato, Irish[d]	..	(25 ppm), 0, ph	0	0	0	(0.1 ppm), 0, C	(1.0 ppm), 0	0 and seed, C, pp
umpkin	..	(25 ppm), 0, pp	0	..	0	(7 ppm), 0	..	0
adish	..	..	..	..	0	..	..	0
hubarb (greenhouse)	..	(25 ppm), 0	..	..	..	(10 ppm), 0	..	..
pinach	..	(100 ppm), 0, pp	..	..	..	7 and wash	..	10
quash	(1 ppm), 0	(25 ppm), 0, pp	0	..	0	(7 ppm), 5	(4 ppm), 5	5
ugar beet[d]	(0.2 ppm-roots, 15 ppm-tops), 21	0	..	..	..	10, B, C, 14, no feeding restrictions	(2 ppm roots, 65 ppm tops), B, 14	..
wiss chard	..	0	..	..	..	..	..	10
omato	(5 ppm), 0	(25 ppm), 0, pp	0	0[g]	0	(4 ppm), 5, F	(4 ppm), 5	5
urnip, rutabaga	..	(2 ppm), pp	..	..	..	10 and wash	..	(7 ppm), 7-tops
Vatermelon	(1 ppm), 0	(25 ppm), 0, pp	0	0	0	5	(0 ppm edible parts), 5[e]	5

[a] No tolerances have been set for these fungicides on dill, horseradish, okra, parsley, and parsnip.
[b] The following abbreviations are used:
- A = Post-harvest application to ferns only or to young plantings that will not be harvested.
- B = Do not feed treated tops or forage to livestock.
- C = Do not use treated seed or seed pieces for feed or food.
- D = Do not apply to exposed bulbs.
- E = Do not apply after fruit buds form.
- F = To avoid damage, do not use on tender young plants.
- pb = Plant bed treatment.
- ph = Post-harvest spray or dip.
- pp = Preplant soil treatment.

[c] Mancozeb is sold as Dithane M-45 and Manzate 200.
[d] Tolerances are not needed for pesticides applied only to the foliage and not translocated to the tubers or roots.
[e] Number indicates number of days between last application and harvest; 0 = up to harvest.
[f] Do not apply if crop is to be used for processing.
[g] Machine harvest only.

LABEL INFORMATION ON FUNGICIDES OF LESS GENERAL USE

Fungicide (tolerance)	Crops and use restrictions
Botran	Beans (snap) — white mold, 2 days to harvest. Do not feed forage to livestock. Greenhouse tomato — to harvest. Do not drench seedlings or newly set transplants. **Carrot** — post-harvest dip or spray, see label. **Garlic, Onion** — soil application before seeding or spray to soil around sets or bulbs. *Do not plant spinach* as follow-up crop in treated soil. **Leaf lettuce** (greenhouse) — 14 days[a] (do not apply to wilted plants or seedlings). **Head lettuce** — 14 days. **Celery** — 7 days. **Cucumber** (greenhouse) — see label. **Rhubarb** (greenhouse) — 3 days. **Potato** — 14 days (do *not* feed to livestock). **Sweet potato** — root dip and plant bed treatment. Note: Do not plant tomatoes as followup in treated soil. Don't use spent roots for food or feed. Post-harvest spray or dip as directed.
Copper fungicides[b]	
tribasic copper sulfate (Kobasic, Triangle, Tri-basic Copper Sulfate, etc.)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, potato, pumpkin, radish, spinach, squash, tomato, watermelon.**
copper sulfate (many)	**Bean, broccoli, cabbage, cantaloupe, cassaba melon, cauliflower, celery, cucumber, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, watermelon.**
copper resinate (Citcop 4E, Cop-O-Cide, Emulsifiable Liquid Copper Fungicide)	**Bean, cantaloupe, cauliflower, chinese cabbage, cucumber, honeydew melon, lettuce, onion, pepper, pumpkin, squash, tomato, turnip, watermelon.**
copper ammonium carbonate (Copper-Count N)	**Bean, cabbage, carrot, crenshaw melon, celery, cantaloupe, cassaba melon, cucumber, honeydew melon, lettuce, muskmelon, pepper, Persian melon, potato, squash, tomato, watermelon.**
copper hydroxide (Kocide 101 and 404)	**Bean, cantaloupe, carrot, celery, cucumber, honeydew melon, muskmelon, pepper, potato, pumpkin, squash, tomato, watermelon.**
copper oxychloride sulfate (COCS, Copro 50 and 53)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cassaba melon, cauliflower, celery, crenshaw melon, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, Persian melon, potato, pumpkin, spinach, squash, tomato, watermelon.**
bordeaux mixture (Acme Bordeaux mixture, Pattersons Bordeaux mixture, Bor-Dox, Ortho Bordo mixture, etc.)	**Cress, cucumber, eggplant, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, turnip, watermelon.**
fenaminosulf (Lesan)	Cleared *only* for seed-treatment [illegible] beans, beets, corn, cucumbers, [illegible] spinach, sugar beets. Do not use t[illegible] seed for food, feed, or oil. Slurry [illegible] treatment for planting in light so[illegible] soils high in clay or organic mat[illegible]
dinocap (Karathane)	**Cantaloupe (muskmelon), cucu[illegible] honeydew melon, pumpkin, s[illegible] watermelon** — 7 days. For contr[illegible] powdery mildew only.
etridiazole (Terrazole, Truban)	Seed treatment: **Beans, peas, sugar** [illegible]
polyethylene polymer (Polyram) (0 ppm)	**Potato, sugar beet** — no time li[illegible] tions. **Celery** — 14 days. **Cantal[illegible] cucumber, tomato** — 5 days. Do [illegible] feed **sugar beet** tops to meat or [illegible] animals. **Celery** — strip, trim, and [illegible] Post-harvest application to aspa[illegible] ferns.
PCNB (Terraclor, Brassicol, Fungiclor) (0.1 ppm)	**Beans** — base of plants *before* blo[illegible]ing, soil and seed treatment at pla[illegible] or foliar spray. Do *not* feed tr[illegible] Bean vines to livestock. Do *not* [illegible] after first bloom. **Broccoli, br[illegible] sprouts, cabbage, cauliflower** — t[illegible] plant solution (3/4 pint per plant) o[illegible] treatment before transplanting. **Pe[illegible] potato, tomato** — soil treatment [illegible] before planting. **Tomato** (field use [illegible]) — transplant solution (1/2 pt. of [illegible] per plant). **Garlic** — soil and seed t[illegible]ment at planting.
streptomycin (0.25 ppm)	**Celery, pepper, tomato** — plant [illegible] only (200 ppm spray); **Potato** — [illegible] piece treatment only (100 ppm di[illegible] dust). Soak cut seed pieces less tha[illegible] min. **Beans** — seed treatment for [illegible] blight control. Do not use treated [illegible] for food or feed.
sulfur, lime, and lime-sulfur	Exempt when used with good agr[illegible]tural practices. See label.
thiabendazole (Mertect)	**Sweet potato** — "seed" root treatm[illegible] Do not use treated pieces for foo[illegible] feed. **Potato** — "seed" tubers only (1[illegible] ppm-20 sec. dip.
thiram, TMTD (0.5-7 ppm)	**Onion** — Furrow treatment. **Celer[illegible]** 7 days (strip, trim, and wash). **S[illegible] potato** — preplant root dip. **Tomat[illegible]** 0 days, for leaf spots and fruit rots. S[illegible] treatment: **Beans, beets, broccoli, b[illegible] sels sprouts, cabbage, cantaloupe, [illegible]rot, cauliflower, collard, corn, cuc[illegible]ber, eggplant, endive, kale, kohl[illegible] lettuce, okra, onion (bulb, seed, [illegible] set), peas, pepper, pumpkin, ra[illegible] spinach, squash, swiss chard, tom[illegible] turnip, watermelon.** WARNING: [illegible] not use treated seed for food, feed [illegible] oil.
triphenyltin (Du-Ter)	**Potato** — early and late blight. Ma[illegible] applied through irrigation systems (s[illegible] set or center pivot only).

[a] Number of days between last application and harvest.
[b] There are many other copper materials, but these are most widely available and labeled for use on vegetable crops. Exempt from tolerance if used with [illegible] agricultural practices; not exempt if used at time of or after harvest. See label.

CONDENSED FUNGICIDE RECOMMENDATIONS FOR DISEASES OF COMMERCIAL VEGETABLE CROPS FOR 1980

Vegetable	Diseases	Fungicide[a]	Remarks
sparagus	Rust (RPD 934)[b], leaf and branchlet blights	zineb, maneb, mancozeb, or Polyram	Apply to non-harvested fields *throughout* season to August 15; to harvested fields *after* cutting only. Apply at 7- to 10-day intervals. May combine with insecticides to control asparagus beetles, cutworms, etc. (Cir. 897).[b] Polyram on ferns only.
	Root rots	mancozeb, captan	Use as a preplant dip.
eans (garden, wax, nd lima)	Seed decay (RPD 915), damping-off, and seed-borne stem blights and root rots	thiram, captan, Terrazole, or chloroneb plus insecticide	Treat seed any time if not previously treated by producer. Plant *only certified*, western-grown seed in warm soil above 65° F.
	Bacterial blights	fixed copper (2-3 lb. metallic/A.)	Apply at weekly intervals. Plant *only certified* western-grown seed.
	Rust, anthracnose, fungus leaf spots, pod and stem spots	maneb, zineb, or Bravo	Apply at 7- to 10-day intervals during moist weather. Combine with insecticides to control bean beetles, aphids, leafhoppers, blister beetles, etc. (Cir. 897).
	Mosaics		Use insecticides to control aphids (NHE-47)[b] that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Control weeds in and around fields (Cir. 907).
	White mold	Botran, PCNB, benomyl	Apply to base of plants just before bloom, or at 25-50% bloom (benomyl). Do not feed treated vines to livestock.
eets (garden and igar), pinach, wiss chard	Seed rot (RPD 915), damping-off, and seed-borne leaf spot and anthracnose	thiram or captan	Treat seed any time or buy treated seed. To control damping-off apply captan (5-7 lb. of 50% WP in 25-30 gal. water/A. or 25-30 lb. of 10% dust/A.) in furrow at planting time.
	Cercospora leaf spot (RPD 951), downy mildew	zineb or fixed copper (2-3 lb. metallic/A.)	Apply every 1 to 2 weeks during rainy periods. May combine with insecticides to control aphids, leafhoppers, caterpillars, leaf miners, etc. (Cir. 897).
	Mosaics, virus yellows		Use insecticides to control aphids (NHE-47) and plant bugs that transmit the viruses. Kill insects before they feed (Cir. 897).
roccoli, russels sprouts, auliflower, abbage, hinese cabbage, ollard, lustard, ale, ohlrabi, adish, utabaga	Seed rot (RPD 915), damping-off, black rot (RPD 924), blackleg (RPD 955), radish black root (RPD 948), Alternaria blight	hot water, then thiram or captan	Buy western-grown seed. Sow *only* seed treated with hot water. Control cabbage root maggots, cutworms, cabbage worms, etc. (Cir. 897). Four-year rotation with non-crucifer crops.
	Wirestem (*Rhizoctonia*) (RPD 902), damping-off, seed rot (RPD 916), Botrytis blight (RPD 942)	PCNB-captan mixture	Dust or spray on soil just before, at, or after planting seed. Follow manufacturer's directions.
	Clubroot (RPD 923)	PCNB 75	Apply in transplant water or starter solution, ¾ pt. per plant (about 400 to 600 gal./A.). Do *not* use emulsion form of PCNB.
	Downy mildew, leaf spots, white rust (RPD 960), anthracnose, Botrytis blight (RPD 942).	maneb, zineb, or Bravo	Apply at 5- to 7-day intervals (3-5 days for radish) in wet weather. Use maneb in seedbed(2 lb./100 gal.). Good coverage important. May need spreader-sticker. May combine with insecticides to control aphids, cabbage worms, etc. (Cir. 897).
	Mosaics, black ringspot		Use insecticides to control aphids (NHE-47) and cabbage worms (NHE-45) that transmit the viruses. Kill insects *before* they feed — especially in seedbeds (Cir. 897).
	Brittle root (primarily horseradish)		Use insecticides to control leafhoppers that transmit the virus (Cir. 897). Apply when leafhoppers are *first* noticed. Additional applications may be necessary if infestation is severe.
Horseradish	Leaf spots	fixed copper	
Carrot, Parsnip	Seed rot (RPD 915), damping-off	thiram or captan	Treat seed any time. May combine with insecticides.
	Aster yellows (RPD 903)		Use insecticides to kill leafhoppers that transmit the mycoplasma, *before* they feed (Cir. 897). Begin when plants are 2-3 inches tall; apply weekly for 4 weeks. Control weeds in and around plantings (Cir. 907).
	Cercospora leaf spot, Alternaria leaf blight (RPD 938)	captan, maneb, mancozeb, zineb, or Bravo	Apply at 5- to 10-day intervals in rainy periods. Thorough coverage essential. Start around June 15.

[a] Dosages: The quantity of material listed is the pounds of active (actual) ingredient to be applied to 1 acre unless stated otherwise (i.e., 3 lb./A.; 2 lb. 50% WP; 20 lb. 5% dust). Abbreviations used: A = acre; WP = wettable powder; pt. = pint(s); gal. = gallon(s); T. = tablespoon(s) (level); sq. ft. = square foot or feet.

[b] RPD = Report on Plant Diseases; NHE = Natural History Entomology publication. General references: Circular 897, 1980 Insect Pest Management Guide — Commercial Vegetable Crops and Greenhouse Vegetables; and Circular 907, 1980 Herbicide Guide for Commercial Vegetable Growers. Materials available from the County Cooperative Extension Service Offices.

Vegetable	Diseases	Fungicide	Remarks
Celery, Parsley	Seed rot (RPD 915), damping-off, seed-borne blights	hot water, then thiram or captan	Treat seed just before planting or buy treated seed. If damping-off starts, spray plants and soil 2 to 3 times, 5-7 days apart. Use zineb (1 T./gal.). Three-year-old seed is free of late blight
	Leaf blights and leaf spots	maneb, zineb, benomyl, Dyrene, Bravo, mancozeb	Apply every 7-10 days in field except during very dry weather
	Mosaics, calico, ringspot		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Control weeds in and around plantings (Cir. 907).
	Aster yellows (RPD 903)		Use insecticides to control leafhoppers that transmit the mycoplasma. Kill insects *before* they feed. Control weeds in and around plantings (Cir. 907).
Corn (sweet and pop)	Seed rot (RPD 915), seedling blights, seed-borne root and stalk rots, leaf blights	Captan. zineb, Vitavax-thiram, or thiram *plus* insecticide	Treat seed any time or buy seed treated with both a fungicide and an insecticide (NHE-27).
	Bacterial wilt (RPD 907)		Apply insecticides over row to control flea beetles (NHE-36) that transmit the wilt bacteria (Cir. 897). One to 6 sprays may be needed, 3 to 5 days apart. Start the day *before* corn comes up.
	Helminthosporium leaf blights	mancozeb, Polyram, or Bravo	Begin when disease first appears. Repeat at 7-day intervals or as required.
	Rust	zineb	Same as above.
Cucumber, Muskmelon (Cantaloupe), Pumpkin, Squash, Watermelon	Seed rot (RPD 915), damping-off, angular and Alternaria leaf spots, Fusarium wilt, gummy stem blight or black rot, anthracnose, scab	captan, or thiram *plus* insecticide	Sow *only* certified, western-grown seed. Watering after planting with captan 50W (2 lb./100 gal. at 1 gal./125 sq. ft., every 5-7 days) controls damping-off. May combine with insecticides (Cir. 897) to control seed-corn maggots (NHE-27) in seedbed. Use 3- to 4-year rotation.
	Bacterial wilt (RPD 905)		Use insecticides to control cucumber beetles (NHE-46) that transmit the causal bacteria. Kill beetles *before* they feed (Cir. 897). Applications needed from young seedlings to mature plants. Thorough coverage is essential.
	Anthracnose (RPD 920), downy mildew (RPD 927), scab (RPD 928), blossom blight, leaf spots and blights (RPD 918), fruit spots and rots, gummy stem blight or black rot	maneb, mancozeb, zineb, Bravo, Difolatan, Dyrene, or benomyl	Use captan or ziram (2-3 lb./100 gal.) on young plants. Apply at 7- to 10-day intervals from seedling emergence to vining. Start other materials *after* vines begin to run. Repeat at 5- to 10-day intervals to 7-10 days before harvest; keep new growth protected. May combine with insecticides to control cucumber beetles, aphids, vine borer, pickle worm, etc. (Cir. 897).
	Angular leaf spot (RPD 919)	fixed copper (2-3 lb. metallic/A.) or soluble copper	Apply at 5- to 7-day intervals in warm, wet weather; or mix with zineb or maneb (2 lb./A.). Begin when plants start to vine or disease *first* appears.
	Mosaics (RPD 926)		Use insecticides to control aphids (NHE-47) and beetles (NHE-46) that transmit the viruses (Cir. 897). Kill insects *before* they feed. Control weeds (Cir. 907).
	Powdery mildew (RPD 925)	Karathane WD, benomyl (8 oz./100 gal.), Bravo *plus* spreader-sticker	Dust or spray. Thorough coverage essential. Repeat 5-10 days later. Do not apply within 7 days of harvest. Use benomyl alone.
Eggplant	Seed rot (RPD 915), seed-borne anthracnose, Phomopsis blight (RPD 949), and Verticillium wilt (RPD 950)	hot water, then thiram or captan	Treat seed just before planting.
	Damping-off (RPD 916)	captan	Seedbed or flat spray, 5 gal./100 sq. ft. Repeat at 5- to 7-day intervals.
	Blight (Phomopsis, Alternaria, Cercospora) (RPD 949), anthracnose	maneb, zineb, or captan	Start when disease is first evident, *or* when first fruits are half mature. Repeat at 7- to 10-day intervals. *Do not use copper fungicides on eggplant.* May combine with insecticides (Cir. 897).
Lettuce, Endive	Seed rot (RPD 915), damping-off (RPD 916), gray mold (RPD 942)	thiram, Botran, ferbam, zineb	Dust seed lightly with captan 75. Then apply Botran as dust or spray just before or just after seeding. For *field use only.*
	Aster yellows (RPD 903), white heart		Use insecticides to control leafhoppers that transmit the mycoplasma. Kill leafhoppers *before* they feed (Cir. 897). Applications needed throughout season. Dust or spray weed borders.
	Mosaics (RPD 946)		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Sow *only* mosaic-indexed seed. Control weeds in and around plant-growing areas (Cir. 907). Keep new and old beds as far apart as possible.

CONDENSED FUNGICIDE RECOMMENDATIONS (continued)

Vegetable	Diseases	Fungicide	Remarks
	Gray mold (RPD 942), downy mildew, other fungus leaf spots, white rust	ferbam, maneb, or zineb	Apply at 5- to 7-day intervals in cool, damp weather. Do *not* apply within 10 days of harvest. May combine with insecticides to control aphids, leafhoppers, flea beetles, etc. (Cir. 897).
		Botran	Botrytis control. Do not apply within 14 days of harvest.
	Sclerotinia	Botran or ferbam	
kra	Seed rot (RPD 915), damping-off	thiram	Seed treatment. Apply any time.
nion, arlic	Smut (RPD 933), seed decay (RPD 915), damping-off, seed-borne purple blotch	thiram or captan	Apply to seed any time (RPD 933). For *onion sets*, use 1 lb. (100% active) to 20 lb. seed; for *bulb onions*, wet seed with Methocel sticker then treat with 8 lb. thiram 75 or captan 75 to 8 lb. seed. For *pickling and green bunching onions*, same as for bulb onions; but use half dosage. Control seed- and bulb-feeding insects (Cir. 897).
	Blast (RPD 931), downy mildew, purple blotch, gray mold blight (RPD 942), neck rot (RPD 930)	maneb, Difolatan, Bravo 6F, Dyrene, mancozeb, or zineb *plus* spreader-sticker	Apply every 5 to 7 days in moist weather. May combine with insecticides to control thrips, onion maggots, cutworms, etc. (Cir. 897).
	Yellow dwarf, mosaics		Use insecticides to control aphids (NHE-47) that transmit the viruses Kill aphids *before* they feed (Cir. 897). Keep new and old plantings *as far apart* as possible.
:a, entil	Seed decay (RPD 915), damping-off, seed-borne foot rots, Ascochyta and Mycosphaerella blights (RPD 945), Fusarium wilts (RPD 912), and bacterial blights	fenaminosulf, thiram, captan, or zineb *plus* insecticide	Treat seed any time or buy seed treated with fungicide-insecticide. Sow certified, western-grown seed. Where captan or thiram are used, friction may reduce seeding rate; add graphite (1 oz./bu.).
	Root rot	dinoseb (Premerge 3)	Apply preplant incorporated, according to the label. Applications of trifluralin for weed control may also provide some control of root rot.
	Leaf and stem spots or blights (RPD 945)	zineb	Apply weekly in rainy weather where diseases have been severe in past.
	Powdery mildew	lime-sulfur dust (4-6 ratio) 30 lb./A.	Do not apply at air temperature above 80° F. or when plants are in flower. Two applications, a week apart, when mildew *first* appears, should be sufficient.
eanut	Seed rot (RPD 915), seedling blights	Botran, thiram, Difolatan, or captan	Treat seed anytime. Do not use treated seed for food, feed, or oil.
otato, Irish	Seed-piece decays (RPD 915), and seed-borne Verticillium wilt (RPD 950)	captan, maneb, Polyram, zineb, or mancozeb	Apply as dust or dip to cut and uncut tubers. Follow manufacturer's directions. Tubers should be well corked over. Plant in warm (over 50° F.) soil.
	Blackleg (RPD 943)	streptomycin	May combine with treatment for seed-piece decays. Use uncut, B-size, certified seed.
	Early blight (RPD 935), late blight (RPD 936), and minor leaf spots and blights	maneb, mancozeb, Difolatan, Bravo, Polyram, Dyrene, Du-Ter	Apply at 4- to 10-day intervals. If rainy, shorten interval; if dry, lengthen. For "finish-up" sprays use fixed copper (3 lb. metallic/A.). May combine with insecticides (Cir. 897).
	Common scab (RPD 909), and black scurf (*Rhizoctonia*)	PCNB(various formulations)	May help on *mineral* soils. Work into top 4-6 inches of soil at or before planting. Follow manufacturer's directions carefully. Dust seed pieces with difolatan or mancozeb.
	Mosaics, leaf roll, mottle, purple-top, yellow dwarf, etc.		Use insecticides to control aphids (NHE-47), leafhoppers (NHE-22), etc., that transmit the viruses. Kill insects *before* they feed (Cir. 897).
	Nematodes	Aldicarb (Temik)	Use where soil tests indicate damaging populations of nematodes.
₹hubarb	Root and crown rots	fixed copper (3 lb. metallic/A.)	Drench crowns early in spring and after harvest. Plant *only* in *well-drained* soil.
	Leaf and stalk spots, anthracnose	captan, Botran	Avoid applications from 2 weeks before harvest until cutting is completed (greenhouse only). May combine with insecticides (Cir. 897).
;weet potato	Black rot (RPD 953), foot rot (RPD 958), Fusarium wilt (RPD 954,) scurf (RPD 957)	Botran	Seed dip or bed spray.
		thiram (1½oz./gal.), thiabendazole	Dip disease-free roots or sprouts just before planting. Follow manufacturer's directions. Seedbed disinfestation (Cir. 893). Three to 4-year rotation. Strict sanitation. Do not rinse after treatment.
	Storage rots (RPD 952)	Botran (as post-harvest dip or in wash water)	Helps reduce transit and market losses caused by Rhizopus soft rot and black rot. Fumigate storage houses with formaldehyde.

CONDENSED FUNGICIDE RECOMMENDATIONS (concluded)

Vegetable	Diseases	Fungicide	Remarks
Tomato, Pepper	Seed decay (RPD 915), seed-borne bacterial spot (RPD 910), speck and canker (RPD 962), early blight (RPD 908), Septoria blight, anthracnose, Fusarium wilt (RPD 929), leaf mold (RPD 941)	hot water, then captan, or thiram	Treat seed, buy treated seed, or certified, disease-free transpla (Cir. 912).
	Bacterial spot (RPD 910)	fixed copper-streptomycin mixture	Start when seedlings emerge and apply every 5 days. In *fie* use fixed copper (2-3 lb. metallic/A.) plus maneb or mancoz (2 lb./A.).
	Damping-off (RPD 916) and seedling blights, collar rot (RPD 908)	captan, ferbam	Dust or spray in seedbed. Apply as plants emerge so spray ru down stems. Repeat every 4 to 7 days until 10 days befo transplanting. Follow the manufacturer's directions.
	Septoria blight (RPD 908), early blight, anthracnose, late blight (RPD 913) and buckeye rot, gray leaf spot, leaf mold (RPD 941)	maneb, mancozeb, Polyram, zineb, Difolatan, Dyrene, Bravo benomyl	Apply every 7 to 10 days *after* first fruit clusters form. Five more sprays may be necessary, depending on weather. Combi with insecticides to control flea beetles, climbing cutworm hornworms, fruit flies, etc. (Cir. 897). *Soil surface spray of man or Difolatan after last cultivation improves anthracnose control.* Tomato leaf mold and Botrytis control.
	Mosaics (RPD 917)		Use insecticides to control aphids (NHE-47) and beetles th transmit the viruses. Kill insects *before* they feed (Cir. 897 Control weeds in and around plant-growing area (Cir. 907). S out certified, virus-free transplants and start with virus-free see
	Blossom-end rot (RPD 906)	calcium nitrate (4-6 lb./A.)	Application of 4 or more consecutive sprays in the regular sche ule may reduce losses. Start when fruits are the size of grape Irrigate to maintain uniform soil moisture.
	Cloudy spot (RPD 914)		Use insecticides to control stink bugs that produce cloudy sp by feeding punctures (Cir. 897).
(General diseases that attack most vegetable crops)	Damping-off (RPD 916) and seedlings blights; gray mold (RPD 942) or Botrytis blight	After planting apply captan, thiram, or zineb (1 T./gal.); ferbam or ziram (2 T./gal.)	Disinfest seedbed soil (Cir. 893), then apply seed treatme (RPD 915). Then apply sprays or drenches after planting Apply *only* if damping-off appears in seedbed and when seedling need water. (*For crucifers, pepper, peas, beans, tomato, lettuce,* ad PCNB to other fungicides to give broad-spectrum control.) Us at least 5 gal. per 1,000 sq. ft. of bed. Repeat at 5- to 7-da intervals when temperature is below 75° F.
	Root knot and other nematodes; Fusarium wilts of various crops (RPD 901,904,912,929, 954)	Heat or chemicals may be used. Consult RPD 1002 for names, general precautions, and directions	Disinfest seedbed soil (heat preferred, if available). Follow man ufacturer's directions exactly. Fumigants work best in ligh loose soils, free of trash, clods, and lumps. Avoid recontamina tion of treated soil. Best to apply fumigants during the fall tha precedes planting. In general, soils must be at least 55° F. a the 6-inch depth with a time lapse of 21-28 days between treat ing and seeding. Some require gas-tight plastic covers.
	Root and stem or crown rots of various crops (RPD 902,911,922,923, 932,948,953)		*Plant resistant varieties when available.*
	Verticillium wilt (RPD 950)		

GENERAL SUGGESTIONS ON FUNGICIDE APPLICATION

1. Cover the foliage uniformly. *Ground equipment* — Apply 75 to 125 gallons per acre at approximately 400 pounds square inch of pressure. Lower volumes and/or pressures may provide adequate coverage, but high-volume, high-pressure appli tions provide ideal coverage. Make sure the sprayer is functioning properly. Check the nozzles for cleanliness and wear. Bo height, accuracy of pressure gauge, agitation, and calibration should also be checked. *Aerial application* — Apply recommen amounts of pesticide per acre in 3 to 5 gallons of water. Make sure nozzles are properly aligned and clean, so uniform appli tion is achieved. Cover a swath no wider than is reasonable for the aircraft and boom being used. Spray only those fields wh are suitable for aerial application. Avoid fields of irregular shape or topography, particularly if they are bounded by power lir trees, or other obstructions.

2. Whenever possible spray when the air is still or when wind velocity is not excessive (less than 10 to 12 mph).

3. Avoid situations where pesticide drift may cause needless problems.

4. When it is compatible with the product label, use a spray adjuvant (surfactant). Some commonly available surfacta are: Colloidal Products X77 (liquid, non-ionic) spreader activator; Colloidal Products Multifilm L. (liquid); Colloidal Produ Spray Modifier (liquid, non-ionic) spreader sticker; Millers Nufilm 17 liquid spreader sticker; Millers Nufilm P liquid spread sticker; Allied Chemical Plyac (liquid) sticker; Rohm and Haas Triton B — 1956 (liquid, non-ionic) spreader sticker; Trit CS7, spreader-binder; and Du Pont Spreader Sticker (liquid) spreader sticker.

1980 Insect Pest Management Guide

COMMERCIAL VEGETABLE CROPS And GREENHOUSE VEGETABLES

Restricted-use insecticides are identified with an asterisk (*).
You must be certified as a pesticide applicator to use restricted-use pesticides.
See your county Extension adviser in agriculture for information.

;OMMERCIAL VEGETABLE GARDENERS find it impossible to roduce vegetables profitably unless they control insects at ıaximum efficiency and minimum cost. The housewife of oday will not accept unsightly wormy vegetables; not only re wormy fruits and vegetables unappetizing but the 'aste from trimming increases food costs. Thus the comıercial vegetable gardener must produce a quality product ıat is acceptable and safe to the consumer. Careful use f the right insecticides will enable him to do this.

Insect pest-management programs, which include the ·ise selection of cultural, mechanical, biological, and hemical methods, are suggested for the major insect pests f vegetable crops. Insecticides, though, are still the most fficient means of managing most insects.

This suggested insecticide guide has been prepared for ise by Illinois commercial vegetable farmers; it is not for ıome gardeners, who should use only those insecticides hat are extremely safe to handle, apply, and store. Furhermore, the commercial vegetable gardener must use a vider variety of insecticides than the home gardener in ırder to obtain maximum insect control at the least cost.

In using insecticides, read the label and carefully follow he instructions. Do not exceed maximum rates suggested; bserve carefully the interval between application and harvest, and apply only to crops for which use has been apıroved. Make a record of the product used, the trade name, he percentage content of the insecticide, the dilution, the ate of application per acre, and the dates of application.

Some of the insecticides suggested here can be poisonous to the applicator. In using them, the commercial grower s expected to use precautions to protect himself, his workrs, and his family from undue or needless exposure.

In using this guide, always refer to the table on the next page, which lists the limitations and restrictions on use. These limitations apply to the vegetables as human food. If you use any portion of a vegetable for livestock food (tops, stalks, etc.), refer to the label for instructions as to he interval required between application and feeding.

The chemical names used in these tables may be unfamiliar to you. These names are the common coined chemical names and as such are not capitalized. Trade names are capitalized. In the table of limitations the common names are listed first. If the trade name is more commonly used, it is listed in parentheses following the common name. Throughout the tables of suggestions, however, the common name is used if there is one. In case you have a question, refer to the table of limitations.

These suggestions are subject to change without notification during the growing season.

Requested label clearances for a few uses of insecticides, carriers, and solvents are uncertain for 1980, since many requests have not been officially cleared. Anticipating needed changes in labeling, we began modifying these suggested uses a few years ago.

Check with your county Extension adviser if you are in doubt about the insecticide you plan to use. We will make announcements of label changes through newsletters and the news media to keep you up to date.

Insecticides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. A person wishing to use an insecticide classified for restricted use must be certified as a private or commercial pesticide applicator by the Illinois Department of Agriculture. Contact your county Extension adviser in agriculture for details on this program.

A few insecticides have been classified at this time. More will be classified later.

Suggestions for the effective use of insecticides from a practical standpoint are based on available data. Soil textures, pH of the soil, rainfall, slope of the field, wind velocity at planting, method and accuracy of application, and other unpredictable factors affect efficiency.

This publication was prepared by entomologists of the University of Illinois College of Agriculture and the Illinois Natural History Survey.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
In cooperation with ILLINOIS NATURAL HISTORY SURVEY CIRCULAR 897 (revised annually) November, 1979

LIMITATIONS FOR FIELD VEGETABLES IN DAYS BETWEEN APPLICATION AND HARVEST AND OTHER RESTRICTIONS ON USE OF INSECTICIDES IN ILLINOIS

(Blank spaces indicate that the material is not suggested for the specific use in Illinois)

Insecticide	Beans	Peas	Broccoli	Brussels sprouts	Cabbage	Cauliflower	Horseradish	Radish	Turnip	Onions	Eggplant	Peppers	Toma-toes
acephate (Orthene)	..	...	..	..	..	..	..	..	....	....	..	7	
*azinphosmethyl (Guthion)[2]	..	...	15	7	21	15	..	..	....	....	..	..	
Bacillus thuringiensis[3]	..	...	0	0	0	0	..	..	....	....	..	..	
carbaryl (Sevin)	0	...	3	3	3	3	3	3	3, 14A	....	0	0	
carbofuran (Furadan)	..	...	..	..	..	..	..	..	....	....	..	21B	
Dasanit	..	...	..	..	..	..	..	..	....	C, D	..	..	
*demeton (Systox)	..	...	..	..	..	..	..	..	....	....	..	3	
diazinon	..	...	5	..	7	5	..	10	10	10	..	..	
dicofol (Kelthane)	7E	...	..	..	..	..	..	..	....	....	2	2	
dimethoate (Cygon)	0E	0E	7	..	3	7	..	..	14	....	..	0	
Dyfonate	..	...	C	..	C	C	..	..	....	....	..	..	
ethion	..	...	..	..	..	..	..	..	....	C	..	..	
malathion	1	...	3	7	7	7	7	7	3	3	3	3	
*methomyl (Lannate)	1	1, 5A	3	3	1	3	..	..	....	....	..	10	
mevinphos (Phosdrin)[2]	..	...	1	3	1	3	..	..	3	....	..	..	
Monitor	..	...	21	21	35	28	..	..	....	....	..	..	
naled (Dibrom)	..	...	1	1	1	1	..	..	4	....	..	..	
oxydemetonmethyl (Meta-Systox R)	..	...	..	..	..	..	..	..	....	....	7F	0B	
*parathion[2]	7	...	7	7	10	7	..	15	10	....	15	15	1
phorate (Thimet)[2]	C	...	..	..	..	..	..	..	....	....	..	..	
rotenone	..	...	..	..	..	..	..	..	....	....	1	1	
trichlorfon (Dylox)	..	...	..	21	21	21	..	..	28E	....	..	21	2

Insecticide	Potatoes	Collards	Kale	Lettuce	Spinach	Swiss chard	Sweet corn	Cucumbers[1]	Melons[1]	Pumpkins[1]	Squash[1] Winter	Squash[1] Summer
Bacillus thuringiensis[3]	..	0	0	0	0	..	..	..	..	..	..	..
carbaryl (Sevin)	0	14	14	14	14	14	0	0	0	0	0	[illegible]
carbofuran (Furdan)	14H	..	..	..	..	..	..	..	..	..	..	..
diazinon	..	10	10	10	10	12	C	7	3	..	3	[illegible]
dicofol (Kelthane)	..	..	..	..	..	..	..	2	2	2	2	[illegible]
dimethoate (Cygon)	0	14	14	14	14	14	..	..	3	..	..	..
Dyfonate	..	..	..	..	..	..	C	..	..	..	..	..
malathion	0	7	7	14	7	7	5	1	1	3	1	1
*methomyl (Lannate)	6	..	..	10	7	..	0, 3A	3	3	..	..	3
*mevinphos (Phosdrin)[2]	..	3	3	2	4	..	..	..	..	..	..	..
Mocap	..	..	..	..	..	..	C	..	..	..	..	..
Monitor	14	..	..	..	..	..	..	..	..	..	..	..
naled (Dibrom)	..	4	4	1	1	1	..	..	..	..	..	..
*parathion[2]	5	10	10	21	14	21	12	15	7	10	15	15
phorate (Thimet)[2]	C	..	..	..	..	..	C	..	..	..	..	..
rotenone	..	1	1	1	1	1	..	..	..	..	..	..
trichlorfon (Dylox)	..	28G	21	28G	..	..	..	..	..	3F	..	..

* Use restricted to certified applicators only.

[1] Apply insecticides late in the day after the blossoms have closed to reduce bee kill.
[2] For use only by professional applicators or commercial gardeners.
[3] The trade names are Bactur, Dipel, and Thuricide.

A. If tops or stover are to be used for feed.
B. Not more than twice per season.
C. Soil applications at planting time only.
D. Do not use on green onion crop.
E. Do not use tops for feed or food.
F. Not more than 3 times per season.
G. Not after edible portions or heads begin to form.
H. Not more than 8 times per season.

REENTRY INTERVALS FOR WORKER PROTECTION

Insecticide	Hours
azinphosmethyl (Guthion)	24
demeton (Systox)	48
ethion	24
parathion	48

Workers must wear protective clothing if they enter treated fields before the time intervals shown at the right. They must also wear protective clothing for all other insecticides applied if the spray has not dried or the dust has not settled.

CABBAGE AND RELATED COLE CROPS

[In]sect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
[Ca]bbage maggots[1] ([N]HE-44)	All season	diazinon Dyfonate	3 2	Broadcast	Disk in just before planting. Use only for cabbage, cauliflower, and broccoli.
		diazinon granules	1	Furrow	At time of planting; on turnips a drenching spray of 1 lb. diazinon should be applied 30 days following treatment.
		*azinphosmethyl diazinon	3 oz. W.P. or 2 oz. E.C. per 50 gal. transplant water 4 oz. per 50 gal. transplant water		6 fluid oz. transplant water per plant.
[Ap]hids (NHE-47) [Th]rips (NHE-48)	All season	*azinphosmethyl dimethoate malathion *mevinphos *parathion	¾ 0.3 1 ¼ 0.4	Foliage	When aphids appear, but before leaves begin to curl.
[Di]amond-back [mo]th larvae; [im]ported cabbage [wo]rms; cabbage [lo]opers (NHE-45)	All season	*Bacillus thuringiensis* *methomyl Monitor	See rates on label 0.45-0.9 1	Foliage	When small worms first appear, and about every 5 to 7 days thereafter. Thorough spray coverage of foliage is important.
[Cu]tworms	At planting	trichlorfon	1	Soil	At planting, at base of plant or as needed when damage first occurs.
[Fl]ea beetles and [lea]fhoppers	All season	carbaryl	1½	Foliage	As needed.

[E.]C. = emulsion concentrate; W.P. = wettable powder.

[*U]se restricted to certified applicators only. [1] Maggots are resistant to diazinon in some areas of Illinois.

COLLARDS, KALE, LETTUCE, SPINACH, SWISS CHARD

[In]sect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
[Ap]hids (NHE-47)	All season	diazinon dimethoate *mevinphos naled *parathion	½ 0.3 ¼ 1 0.4	Foliage	As needed.
[Cu]tworms	On seedling plants	trichlorfon	1	Base of plant and soil	When first damage appears.
[Le]afhoppers	All season	carbaryl dimethoate malathion	1½ 0.3 1	Foliage	When first leafhoppers appear, and as needed.
[Ca]terpillars ([N]HE-45)	All season	*Bacillus thuringiensis* methomyl[1] naled	See rates on label 0.45 1	Foliage	When small worms first appear and every 5 to 7 days thereafter.
[Le]af miners	All season	diazinon dimethoate *parathion	½ 0.3 0.4	Foliage	When first miners are observed.
[Fl]ea beetles	All season	carbaryl rotenone	1 ¼	Foliage	As needed.

[*U]se restricted to certified applicators only. [1] Use limited to lettuce and spinach only.

BEANS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Seed maggots (NHE-27)	All season	diazinon 50% W.P.[1]	3/5 oz./bu.	Seed	Treat seed no longer than 3 months be
		Lorsban 25% W.P.[1]	2 oz./bu.	Seed	planting.
		phorate granules	1½	Soilband	Place on either or both sides of row planting but not in contact with seed
Bean leaf beetles (NHE-67)	Early and late season	carbaryl	1	Foliage	When feeding first appears and wee for 2 or 3 applications as needed.
		malathion	1		
Leafhoppers (NHE-22) and plant bugs (NHE-68)	All season	carbaryl	1	Foliage	Before plants become yellow and stun Repeat applications at weekly inter as necessary.
		dimethoate	0.3		
		malathion	1		
		*methomyl	0.45		
		phorate granules	1½	Soilband	As for seed maggot.
Mexican bean beetles	Midseason and late season	carbaryl	½	Foliage	When occasional leaves show lacew feeding.
		malathion	1		
		phorate granules	1½	Soilband	As for seed maggot.
Aphids (NHE-47)	All season	dimethoate	0.3	Foliage	Usually applied when a few aphids can found on each plant, but before lea begin to curl and deform.
		malathion	1		
		phorate granules	1½	Soilband	As for seed maggot.
Blister beetles (NHE-72)	Midseason and late season	carbaryl	1½	Foliage	As needed.
Corn earworms (NHE-33) Corn borers	Late season	carbaryl	1½	Foliage	As needed, but usually after August Worms may be present before bloom.
		*methomyl	0.45		
		*parathion	½		
Mites	Midseason and late season	dicofol	0.4	Foliage	As needed, but especially during drout periods particularly if carbaryl has be used on crops.
		dimethoate	0.3		
		malathion	1		
		phorate granules	1½	Soilband	As for seed maggot.

* Use restricted to certified applicators only. [1] No restrictions when used as recommended.

CUCUMBERS AND OTHER VINE CROPS[1]

Insect	Time of attack	Insecticide[2]	Pounds of active ingredient per acre	Placement	Timing of application[1]
Striped and spotted cucumber beetles (NHE-46)	Seedling to mature plants	carbaryl	1	Foliage	When beetles first appear; as often necessary thereafter.
		*parathion	½		
Aphids (NHE-47)	All season	diazinon	½	Foliage	When aphids become noticeable.
		dimethoate[2]	0.3		
		malathion	1		
		*parathion	½		
Squash bugs (NHE-51)	All season	*parathion	½	Foliage	Do not apply until first eggs are fou hatching (about June 15 to July 15).
		trichlorfon[3]	1		
Leafhoppers	July-August	malathion	1	Foliage	As needed.
		dimethoate[2]	0.3		
Squash vine borers	June-September	carbaryl	1	Base of stem for 3 ft.	Weekly applications when vines begin run—usually 5 applications.
Pickle worms	August-September	carbaryl	1	Foliage	Weekly applications, beginning in la August.
Mites	July-September	dicofol	½	Foliage	As needed.
		malathion	1		
		*parathion	½		
Cutworms (NHE-77)	April-June	carbaryl	2	Base of plants	As needed.

* Use restricted to certified applicators only.

[1] Spray vine crops with insecticide only late in the day after blossoms have closed to reduce bee kill. [2] Do not use dimethoate on cucumber
[3] Pumpkin is the only vine crop for which trichlorfon can be used for squash bug control.

TOMATOES AND EGGPLANT

ect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
worms HE-77)	Early and midseason	carbaryl trichlorfon	2 1	Base of plants or foliage	As needed.
a beetles	May-June	carbaryl rotenone	2 0.2-0.4	Foliage	Apply every week as long as needed.
nids (NHE-47)	May-July	diazinon dimethoate[1] malathion *parathion	¼ 0.3 1 0.4	Foliage	As needed, but before leaves curl.
bbage pers	July- September	*Bacillus* *thuringiensis* *methomyl	See rates on label 0.45-0.9	Foliage	When loopers are present.
rn earworms rn borers	July- September; occasionally in June	carbaryl *methomyl[1]	2 0.45-0.9	Foliage	Add to weekly applications of fungicide sprays beginning at first fruit set. If spraying is infrequent, use 6 lb. of toxaphene.
rnworms	July- September	carbaryl trichlorfon	2 1	Foliage	When first small worms appear.
tes	July- September	carbophenothion dicofol malathion *parathion	1 ½ 1 0.4	Foliage	As needed.
sset mites	July- September	*parathion sulfur dust[2] sulfur spray[2]	0.4 10 10	Foliage	As needed.
ster beetles HE-72)	June- September	carbaryl *parathion	1½ ¼	Foliage	As needed.
uit flies and nic beetles	August- October	diazinon spray diazinon granules	½ 1	Foliage	When flies or beetles first appear.
		pyrethrin dust[2]	1	Foliage	Apply to hamper immediately after it is filled.

Jse restricted to certified applicators only. [1] Use cleared only on tomatoes. [2] No limitations on use.

PEPPERS

sect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
hids (NHE-47)	May-July	dimethoate demeton *methomyl oxydemetonmethyl acephate	0.3 ⅜ 0.45 ½ ½	Foliage	Only when aphids are present. Add to borer spray when it is being used.
rn borers	Late season	carbaryl acephate	2 1	Foliage and fruit	When fruit is present on plant. Apply every 5 days when borers are present.
		carbofuran	2-3	Soilband to transplant	Make 2 applications; first, 3 weeks after transplant, second, 5 weeks later.

Jse restricted to certified applicators only.

ASPARAGUS

sect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
paragus beetles HE-49)	Early and mid- season on spears and ferns	carbaryl[1] malathion[1] rotenone[1]	1½ 1 0.2-0.4	Spears and ferns Spears	As needed, not more often than every 3 days. As needed.

ne-day restriction between last application and harvest.

SWEET CORN

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Soil insects (NHE-26, 27, 43)	April-August	diazinon Dyfonate Mocap phorate	1 1 1 1	Row	Apply on soil surface behind planter se and ahead of press wheel. Rootworm c- trol may be needed if the corn was t sprayed the previous year.
Cutworms (NHE-38)	April-June	carbaryl[1] carbaryl bait	2-3 1	Base of plants	When first damage appears.
Flea beetles (NHE-36)	April-July	carbaryl[1]	1½	Foliage	As necessary.
Japanese beetles (NHE-32)	July-September	carbaryl[1]	1	Ear zone	As necessary.
First-generation corn borers	June	carbaryl[1]	2	Foliage	Make first application when tassel ra is 30 to 40. Repeat in 4 to 5 days.
Second-generation corn borers and corn earworms[2] (NHE-33)	June-September	carbaryl[1] *methomyl	2 0.45	Ear zone	*Fresh market corn:* At first silk and eve 2 to 3 days for 5 to 8 applications. *Ca ning corn:* Observe light traps for earwo and borer adults, or keep a record of t heat units. When 1,500 or more heat un have accumulated, begin a spray pr gram. As an alternative, begin at 30 50% silk and every 3 days thereafter un the corn is within 8 to 12 days of harve
Sap beetles (NHE-10) Picnic beetles	July-September	carbaryl[1] diazinon malathion *parathion	2 1 1 ½	Foliage	When adults first appear in field; usua between pollen-shedding and silk-dryir
Corn leaf aphids (NHE-29)	July-September	malathion *parathion	1 ½	Foliage	As needed to produce attractive ears f fresh market.
Fall armyworms	July-September	*methomyl *parathion	0.45 ½	Foliage	Apply to ear zone when whorl feeding evident.

* Use restricted to certified applicators only.

[1] During pollen shed, apply carbaryl as late in the day as possible (preferably after 4 p.m.) to reduce bee kill. [2] Adding 0.5 to 0.75 pound parathion or 0.25 to 0.45 pound of methomyl to carbaryl improves earworm control.

ONIONS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Onion maggots (NHE-50)	All season	diazinon W.P. ethion W.P.	½-1 for 40-50 lb. of seed 1 for 40-50 lb. of seed	Seed	Seed treatment for set onions only. Us lighter dosage of diazinon on sandy, highl mineral soils.
		Dasanit granules diazinon granules Dyfonate ethion granules	1 ½-1 1 ½-2	Furrow	Use 1 lb. active ingredient per acre fo rows 12″ apart; ¾ lb. for rows 18″ apart ½ lb. for rows 24″ apart. Up to twic these amounts are needed for ethion o muck soils. Do not use Dasanit or Dyfonate on green onions.
		diazinon	2	Broadcast	Preplanting; disk into upper 1 to 2 inche of soil. Supplement with foliage spray below.
		diazinon malathion	⅓ 1	Foliage	Supplemental to soil treatment. Make first application when first adult flies are seen; make another 1 week later. From then on only as necessary.
Thrips (NHE-48)	Midseason and late season	diazinon malathion *azinphosmethyl (Guthion)	½ 1 ½	Foliage	When injury first appears and every 10 days as necessary.

* Use restricted to certified applicators only.

POTATOES

I…ect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Fl… beetles	May-July	carbaryl	1	Foliage	When damage first appears on the leaves. Repeat as needed.
		carbofuran granules	3	In furrow	Planting time.
		carbofuran spray	1	Foliage	Planting time.
		*methomyl	0.45	Foliage	Planting time.
		Monitor	1	Foliage	Planting time.
Co…rado potato b…tles	May-July	carbaryl	1	Foliage	As needed.
		carbofuran granules	3	In furrow	Planting time.
		carbofuran spray	1	Foliage	Planting time.
		Monitor	1	Foliage	Planting time.
P…ato leafhoppers (…HE-22)	May-July	carbaryl	1	Foliage	Weekly applications when the leafhoppers first appear.
		carbofuran granules	3	In furrow	Planting time.
		carbofuran spray	1	Foliage	Planting time.
		dimethoate	0.3		
		*methomyl	0.45		
		Monitor	1	Foliage	Planting time.
		phorate granules	2-3	Soilband	Place on either or both sides of row at planting, but not in contact with seed. Use the lower rate on sandy soils, the heavier rate on heavy soils. Do not use on muck soils.
…hids (NHE-47)	All season	dimethoate	0.3	Foliage	As needed.
		Monitor	1		
		*methomyl	0.45		
		*parathion	¼		
		phorate granules	2-3	Soilband	Same as for leafhoppers.
…tworms	May-July	carbaryl	2	Foliage	As needed.
…lister beetles (…HE-72)	All season	carbaryl	1½	Foliage	As needed.
…ireworms (NHE-43) …hite grubs (NHE-23)	All season	phorate granules	2-3	Soil	Preplanting, disk in; or use as soilband at planting.
…asshoppers (…HE-74)	July-September	carbaryl	¾	Foliage	As needed, control in fence rows, roadsides, ditch banks, etc., before migration.
		dimethoate	0.3		

…Use restricted to certified applicators only.

PEAS

…sect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
…aterpillars, …cluding loopers	June	*methomyl	½-1	Foliage	Before harvest if worms are present.
…phids	May-June	dimethoate	⅓	Foliage	As needed.

…Use restricted to certified applicators only.

Limitations for Greenhouse Tomatoes

Insecticide	Tomatoes
endosulfan (Thiodan)	15 hours
malathion	15 hours
metaldehyde	As bait applied only to soil
naled (Dibrom)	1 day
*parathion[1]	10 days

* Use restricted to certified applicators only.

[1] Do not use aerosols that contain parathion or the propellant methyl chloride in greenhouses connected to living quarters.

GREENHOUSE TOMATOES

Insect	Insecticide[1]	Dosage and formulation	Application
Aphids Whiteflies	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	naled vapor	5 oz. of 4% E.C. per 50,000 cu. ft.	Apply on steampipes.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
Mealybugs Spider mites Russet mites Thrips		Use malathion or parathion aerosol as suggested for aphid and whitefly.	
Armyworms Cabbage loopers Cutworms Tomato fruitworms	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
Slugs	metaldehyde	Commercially prepared bait or spray	To mulch on soil surface. Do not contaminate edible parts.

* Use restricted to certified applicators only.

[1] See page 7 for limitations between application and harvest.

FOR ADDITIONAL INFORMATION

Obtain the following circulars on insect control from the Office of Agricultural Publications, 123 Mumford Hall, Urbana, Illinois 61801.

Circular 899, 1980 Insect Pest Management Guide — Field and Forage Crops

Circular 900, 1980 Insect Pest Management Guide — Home, Yard, and Garden

Circular 1076, Turfgrass Pest Control

Leaflets describing the life history, biology, and habit of some of the insects mentioned can be obtained from the offices of county Extension advisers or by writing to Entomology Extension, 172 Natural Resources Building, Urbana, Illinois 61801. These are indicated by an NHI number in the tables.

FOR YOUR PROTECTION

Always handle insecticides with respect. The persons most likely to suffer ill effects from insecticides are the applicator and his family. Accidents and careless, needless overexposure can be avoided. Here are a few easy rules that if followed will prevent most insecticide accidents:

1. Wear rubber gloves when handling insecticide concentrates.
2. Do not smoke while handling or using insecticides.
3. Keep your face turned to one side when opening insecticide containers.
4. Leave unused insecticides in their original containers with the labels on them.
5. Store insecticides out of reach of children, irresponsible persons, or animals; store preferably in a locked cabinet.
6. Triple-rinse and bury or burn all empty insecticide containers or take to an approved sanitary landfill.
7. Do not put the water-supply hose directly into the spray tank.
8. Do not blow out clogged nozzles or spray lines with your mouth.
9. Wash with soap and water exposed parts of body and clothes contaminated with insecticide.
10. Do not leave puddles of spray on impervious surfaces.
11. Do not apply to fish-bearing or other water supplies.
12. Do not apply insecticides, except in an emergency, to areas with abundant wildlife or to blossoming crops visited by bees. Avoid drift onto blossoming crops or onto bee hives.
13. Do not apply insecticides near dug wells or cisterns.
14. Do not spray when weather conditions favor drift.
15. Observe all precautions listed on the label.
16. To avoid bee kill, apply insecticides after bee activity has been completed for the day; use the least toxic materials. *Warn beekeepers that you are applying insecticides.*

UNIVERSITY OF ILLINOIS PLANT CLINIC

Nancy R. Nicol

Although the concept of plant pest identification and control has existed for over 100 years, the plant diagnostic lab phenomenon is a relatively recent occurrence. At the University of Illinois specialists in Plant Pathology have been handling mailed plant problems since 1961. At that time the Plant Clinic building was only a gleam in the eye. Weed Science, Botany, Entomology and other plant related departments have also handled their share of plant specimens and/or questions. In order to get an answer to a specific problem, county extension advisors and other individuals frequently found themselves fruitlessly searching for the correct expert. Meetings, field work, and other responsibilities often required these experts to be away from their offices. It soon became apparent that a central receiving station and diagnostic lab was needed--a place where all plant problems could be directed and where specialists could easily check in when needed.

After untold hours in planning, writing proposals, meeting, and coordinating, Dr. R. E. Ford, Dr. E. L. Knake, Dr. M. C. Shurtleff, Mr. D. B. Bauling and others finally hatched the University of Illinois Plant Clinic. The building was constructed in 1975 and operations began in June, 1976. This is the first university clinic where all plant science departments, as well as the Illinois Natural History Survey and the Agricultural Engineering department cooperate in such a venture.

The Plant Clinic was constructed on St. Mary's Road, Urbana, in the northeast corner of the South Farm. The building contains a receptionist office, 2 staff offices, a library-conference room, restrooms, laboratory, and a garage large enough to house the mobile diagnostic lab. The building has also allowed for the opportunity for research on solar heating.

The Clinic is open only in summer months, May-September, although at other times of the year samples are still received by departmental experts. The reason for limited operations is the universal problem of a lack of funds. The 1976 season of operation was overseen primarily by Plant Pathology and Agronomy staff as well as volunteers. The 1977 and 1978 seasons found adequate funds for a coordinator position, secretarial help, and even a part-time technician in 1978 and 1979. Steps have been taken and hopes are high for a full year funding by 1981.

Due to the tight operating budget at the Plant Clinic, it has become necessary to institute a charge policy. A charge of $5.00 per sample ($10.00 per nematode sample) is made for any sample brought or mailed directly to the Plant Clinic by individuals who do not use the expertise of the Cooperative Extension Service. The Plant Clinic is an extension facility intended as a service to the extension adivsors in each Illinois county. Samples submitted through extension are free of charge.

Nancy R. Nicol is Assistant Plant Pathologist, Department of Plant Pathology.

The turn-over time for plant specimens varies with the work load. As the Clinic staff expands to handle the sample load, one-day service should be attained in many cases.

The Plant Clinic is equipped to handle plant disease diagnosis, plant weed and insect identification, herbicide injury, nematode analysis, and nutritional problems. In general, any plant problem in the state can be submitted to the Plant Clinic. In many cases more than one expert will be consulted. Rarely is the problem solely in one discipline alone.

Preparation of Plant Samples for Diagnosis

N. R. Nicol

Accurate diagnosis of plant problems depends on the receipt of fresh, representative plant samples as well as the completion of a Specimen Data form for <u>each</u> sample. Forms are available from your county cooperative extension advisor.

The arrival of dead plant material or decomposed plant tissue is of little or no value in diagnosis. These samples <u>will not</u> be diagnosed. Samples which arrive without a completed data form will be handled as time permits. Samples without any accompanying identification will be discarded.

<u>SAMPLE COLLECTION</u>

1. Collect both healthy and affected areas of the plant. This provides a comparison once plants have survived the mail.

2. Send the entire plant, with roots, if feasible. This is especially important for plant identification.

3. Rotted plants are useless. Select plants showing early signs of decline.

4. Dig, <u>do not</u> pull, plants from the soil so diseased roots remain intact.

SAMPLE SUBMISSION

1. For suspected leaf problems, press whole leaves between heavy cardboard.

2. Fleshy plant parts should be wrapped individually in newspaper or paper toweling and packed in a crush-proof box. Do not wrap in plastic and do not add moisture to the samples.

3. When submitting whole plants, wrap soil and roots in plastic, seal at the stem, and leave tops packed loosely in newspaper or toweling.

4. If plant species or samples are mixed in the same mailing container, label each separately and keep labels away from moisture. A data form must be included for each sample.

5. Mail samples early in the week to avoid weekend layover in a Post Office. Keep samples cold until mailed.

6. Send samples to: Plant Clinic
St. Mary's Road
Urbana, IL 61801

Nematode caused diseases require special attention. See Report on Plant Disease No. 1100 for detailed instructions on the handling and shipping of nematode infested material.

For fertility induced problems, properly taken soil samples should be sent to a private soil analysis laboratory to determine possible nutrient deficiencies and/or excesses. The Plant Clinic does not perform soil analysis (except for nematodes).

NOTE: The most important part of sample submission is to provide background information on the problem as well as symptom expression. The more information provided the quicker we can diagnose the problem.

Proceedings

1981 Illinois Vegetable Growers Schools with grower suggestions

University of Illinois at Urbana-Champaign
Agricultural Experiment Station
Cooperative Extension Service, College of Agriculture

January, 1981
Department of Horticulture Series 23

FOREWORD

This Proceedings is a record of the information presented at the 1980-81 Illinois Vegetable Growers Annual Meeting and Regional Schools. It also provides current research findings along with progress reports and extension recommendations. As a multi-purpose publication, no one individual is expected to find all of the information of value. However, portions of the report will be useful for commercial vegetable growers, county extension advisors, industry representatives and research scientists.

Thanks and appreciation are due the commercial seed companies, agricultural chemical manufacturers and suppliers, the Illinois Vegetable Growers Association and commercial growers who support and participate in our research and extension programs.

Additional copies of this Proceedings are available at a cost of $3.00 each. Make checks available to the University of Illinois and send your order to the Department of Horticulture, 124 Mumford Hall, Urbana, IL 61801. A limited supply of the 1980 Proceedings is also available for $3.00 each.

J. M. Gerber

J. M. Gerber
Editor of Proceedings

This publication was compiled and edited
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THE BACTERIAL SPOT DISEASE OF PEPPERS AND TOMATOES

Barry J. Jacobsen

PRESENTATIONS

The bacterial spot disease of peppers and tomatoes has caused serious losses to midwestern vegetable growers during the last three years. This disease is caused by the bacterium Xanthomonas vesicatoria and can be spread by splashing rains, infected transplants, or infected seed. Since control of the disease in the production fields is difficult, growers must take every precaution to avoid introducing the bacterium into fields.

Bacterial spot disease development and spread is favored by warm (75-86° F.) temperatures, however if temperatures exceed 100 F. for several days, bacterial populations will be reduced. Wet conditions are also necessary for infection. Infections usually take place through water gorged stomates or lenticles although they can also occur at wound sites. Severe outbreaks often follow violent thunderstorms where leaves are wounded by strong winds or hail. Spread of bacterial plant pathogens in aerosols formed by splashing rain, or 1/2-1 mile from the inoculum source has been shown by several researchers.

Xanthomonas vesicatoria survives between growing seasons on crop residues, infected seed, volunteer plants and, weed hosts such as nightshade, ground cherry, Jimson weed, currant tomato, henbane, wild tobacco, bittersweet, buffalobur, matrimony vine and a close relative Lycuim chinese. There are also reports in the literature that the bacterium can survive as an epiphyte on wheat roots. It is not known whether this survival mechanism also occurs with other crops which might be rotated with pepper or tomato. The disease is most often introduced on infected transplants brought in from southern states.

The literature contains several reports of strains of this organism which are specific for pepper or tomato, however, spread between these crops by at least one strain has been reported. Therefore, movement from one crop to the other should be considered in disease control.

Symptoms on peppers

Infected plants in the seedbed have small spots that are irregular and black, usually along the edge of the cotyledon leaves. Older plants develop small, circular spots that are pale-green and slightly raised (lesions on the underside of the young leaves) with slight depressions on the corresponding upper surfaces. As the spots enlarge, they become pale yellow with dark-brown borders.

The center of the lesion often dies and collapses. As a rule, the spots do not run together. On older leaves of plants in the field, the lesions are usually dark-green and water-soaked, not noticeably raised, and up to 1/8 to 1/4 inch in diameter. Later, these spots have dead, pale-yellow centers with dark-brown borders. When numerous, the lesions remain brown. Spotted leaves may turn yellow and fall any time during the season. Some leaves drop off while they are still green. Seedlings infected in the plant bed may lose all but their top leaves. The spots on pepper fruit are blister-like, roughly circular, and up to 1/4 inch in diameter. They have a cracked, roughened, or warty appearance. The spots are a pale green at first, but soon turn brown. In moist weather, various decay-producing bacteria and fungi enter through the lesions, causing the fruit to rot before or after harvest.

Spots on the stem are small, elongated, and raised. Generally, however, they are not very conspicuous.

Symptoms on tomatoes

The symptoms on young plants are similar to those on peppers. Leaf spots appear as small (1/8-inch) lesions that are water-soaked and translucent. Later, they turn brownish-black. The lesions are somewhat irregular and have a greasy appearance on the upper leaf surface. The centers of the spots dry out and frequently tear. Only a few spots may cause a leaflet to turn yellow, wither, and drop prematurely. Lesions on the flower stems (pedicels) also cause the blossoms to blast and to drop.

Spots on the green fruit appear first as small, black, raised "pimples" surrounded by narrow, water-soaked borders. Later, the raised portion sinks, forming a cavity and the typical lesions that are rough, brown, and scab-like. Ripe fruit is not infected. The spotting of the fruit and dropping of the flowers are the most serious phases of the disease in Illinois.

Control of Bacterial Spot

Use Pathogen-Free Seed. Control of the bacterial spot disease must start with pathogen-free seed. At the present time the only proven effective treatment is a hot-water soak at 125° F. for 30 minutes for pepper or 122° F. for 25 minutes for tomato. The hot water soak will also control seed-borne bacterial canker of tomato. While seed germination is sometimes lowered by hot water treatment, it is a small cost compared to the potential losses from the disease. Since germination of individual varieties or seed lots may be more severely damaged than others, small lots should be used to test the ability to withstand heat treatment. In general, growers should have their seed treated by the seed dealer since this can be a tricky procedure with absolute temperature controls required.

Some seed producers are using sodium hypochlorite soaks to treat tomato and pepper seed to eliminate bacterial pathogens. While circumstantial evidence suggests this method works well, experimental evidence using contaminated seed lots is lacking.

Production of Disease-Free Transplants

If plants are greenhouse grown, all tomato or pepper residues from the proceeding year must be removed, sterile potting mixture used, and flats or other previously used containers disinfected. Care should be taken not to work amongst wet plants and plants should be watched closely for signs of disease.

If plants are field grown, strict crop rotation and sanitation procedures must be followed. Fields selected for tomato or pepper transplant production should not have produced either of these crops within the proceeding 2 years in southern transplant areas and 3 years in the midwest. Wheat or other small grain should not be used as a rotation crop. Volunteer pepper or tomato plants or weed hosts of *X. vesicatoria* should not be present in or near the seedbed site. Seedbeds should not be located where drainage water from "old" pepper or tomato fields can reach the plant bed.

Plant beds should be thoroughly inspected by a qualified person for the presence of foliar symptoms of bacterial spot and speck on tomato or bacterial spot on pepper. If positive identification is made, infected plants and those nearby should be removed and destroyed. Remaining plants should be closely watched and if other plants are found infected the entire seedbed should be destroyed. Equipment used in a plant bed in which infection is found should be decontaminated before reuse. WORKERS OR EQUIPMENT SHOULD NEVER BE USED IN THE PLANT BED WHEN PLANTS ARE WET.

Plant beds should be sprayed with copper & streptomycin on a weekly basis to prevent buildup, spread, and infection. Spray intervals should be shortened during wet weather.

Clipping or mechanical topping of transplants to reduce size should be avoided. This practice can easily spread a small amount of disease to an entire seedbed.

After pulling, plants should not be sprayed or dipped in water prior to transplanting. Plants should be placed in new crates or if old crates are used, they should be disinfested. Plants remaining in the plant bed after pulling should be destroyed.

Purchase Disase-Free Transplants

Pepper or tomato growers should contract for transplants only from growers who agree to produce plants according to the forementioned guidelines. The plant bed should be inspected several times by qualified personnel. If the state in which the plants are produced has a certification procedure, the transplant producer should participate. Proof of participation and compliance with certification procedures should be required by transplant purchasers. Purchasers should ask for the following information in addition to the certification tag: a) the seedlot number, b) seeding and pulling date, c) verification that the plants have not been clipped or topped, d) plant bed spray schedule, and e) plant bed inspection schedule and inspectors name.

Do not soak or spray transplants with water prior to transplanting.

Crop Production to Minimize Bacterial Spot

Select fields where pepper or tomato crops have not been produced within the proceeding 3 years. Avoid fields where drainage could carry pathogens from "old" pepper or tomato fields. Weed or volunteer crop hosts of *X. vesicatoria* should be eliminated from in or around production fields.

Protection of young plants from blowing soil using windbreaks or strips of corn or other early planted crops will help minimize leaf damage during storms. Control insect pests since they may be involved in spread of the bacterial spot organism.

DO NOT WORK AMONGST WET PLANTS -- WAIT TILL THEY ARE DRY FROM DEW OR PRECIPITATIO

Spray plants on a 5-7 day schedule with maneb or manocozeb (Dithane M45 or Manzate 200) + copper. By thoroughly inspecting plants for infection, early sprays could be avoided. This may be helpful since copper does harden young plants. Recent unpublished research indicates that better disease control will result if the maneb or manocozeb + copper is allowed to mix in the spray take for 1-2 hours prior to application. The reason for this is not known at this time. Evidence indicates that boom sprayers are less likely to spread bacterial diseases than are airblast type sprayers.

In general, the control measures used prior to field spraying are for more important and effective than field spraying. Field spraying will help hold back the disease "at best." Suppressing the disease in the field depends more on the absence of wet, windy weather than field applications of copper.

Resistant varieties?

While resistance occurs in the non-bell type peppers, resistance in bell types is not widely available. Personal communication with Florida researchers indicates that the Yolo type peppers may have some tolerance (fruit are not easily infected) and that Florida VR2 has resistance to one strain of *X. vesicatoria*. At the time Florida VR2 was released it was resistant to the prevailing Florida strain, but within 1-2 years another strain appeared which successfully attacked this variety. We are currently screening these and other bell type peppers with Illinois isolates of *X. vesicatoria*.

Barry J. Jacobsen is Associate Professor and Extension Specialist in Plant Pathology

MICRONUTRIENT APPLICATIONS TO VEGETABLE CROPS

John M. Gerber

It has often been stated and confirmed in research trials that micronutrients exist in adequate supply in most Illinois soils. Nevertheless, there has been a disproportionate concern with micronutrient deficiencies among vegetable growers. This concern is due to an increased awareness by many growers. Unfortunately, this may be a case of a little knowledge being non-productive, as some growers may become unnecessarily preoccupied with micronutrient fertility.

The awareness of micronutrients is probably due to a number of factors. 1) There has been an increased number of popular articles in the agricultural press describing relatively rare deficiency problems. Unfortunately, the emphasis has been on the deficiency rather than the rarity: 2) We have experienced a marked increase in the availability of micronutrient products, each accompanied by convincing sales literature; 3) New and more precise measuring devises have allowed researchers to examine the role of micronutrients in plants, thus stimulating interest and concern.

Vegetable growers, preconditioned by the experience of dramatic yield increases from nitrogen, phosphorus and potassium applications, are easily convinced of the need for micronutrients. Salesmen and colorful advertisements expound the benefits of micronutrients and the dangers of "hidden hunger". Growers are told that they have reached another yield plateau and a micronutrient may now be the limiting factor. A picture of a barrel with various length staves is used to convince growers that their profits may be "leaking out".

Micronutrients are often described as cheap insurance to prevent the possibility of hidden hunger. Growers who feel that insurance is worth the additional cost should not be discouraged from applying most micronutrients. It is doubtful that they will do any harm by applying iron, manganese or zinc at recommended rates. One exception to note is boron which should be applied with discretion because toxicity can be a serious problem.

Diagnosis

Vegetable producers who suspect a micronutrient deficiency should be encouraged to contact Cooperative Extension Service personnel for aid with diagnosis. Neither pictures nor written ddescriptions of deficiency symptoms are of much help without soil tests, plant tissue analysis and previous experience. Even then diagnosis is very difficult.

Soil test results are often misleading because chemical extractants may remove more total nutrient than is actually available to the plant. Even tissue tests are not always conclusive. Plants known to be suffering from iron deficiency have often been shown to contain more total iron in their leaves than healthy green plants. Also, since the primary cause of most micronutrient deficiencies is high pH or alkaline soil, multiple deficiencies may appear. This makes diagnosis of specific problems almost impossible.

The difficulty in diagnosis or prediction of individual micronutrient deficiencies often leads growers and specialists alike to throw up their hands in defeat. This makes multi-nutrient applications of micronutrients seem especially appealing. However, we must be reminded that micronutrient deficiencies are rare and usually occur in fairly predictable instances. Growers should be aware of which crops are susceptible to specific deficiencies and the environmental conditions in which they are likely to occur. By avoiding described environmental conditions, micronutrient deficiencies can usually be prevented without fertilizer. In a limited number of cases micronutrient applications will be advised.

Micronutrients

Plant nutrients are considered micronutrients because they are needed in very small amounts. Although an absence of molybdenum is just as severe a lack of adequate nitrogen, it is much less likely to occur. Table 1 describes the relative amounts of fertilizer elements required by vegetable crops. Note that 150,000 times more nitrogen is needed than molybdenum. Growers should therefore be expected to be 150,000 times more concerned with nitrogen than with molybdenum. However, this is not always true, and undue emphasis is often placed on the micronutrient status of the soil and plant.

TABLE 1. Relative Amounts of Fertilizer Elements Required by Plants

Molybdenum (Mo)		1
Copper (Cu)		60
Zinc (Zn)		200
Boron (B)		200
Manganese (Mn)	micronutrients	500
Chlorine (Cl)		1,000
Iron (Fe)		1,000
Sulfur (S)		10,000
Phosphorus (P)		20,000
Magnesium (Mg)		20,000
Calcium (Ca)	macronutrients	50,000
Potassium (K)		100,000
Nitrogen (N)		150,000

The relative availability of a nutrient in the environment is also an important factor to consider. The information in Table 1 fails to account for this. For example, chlorine deficiencies have never been found to exist outside of the laboratory. Not only is chlorine required in small amounts, it is generally available in quantities far exceeding the need. Likewise most soils contain adequate calcium, magnesium, sulfur and all the micronutrients. However, under certain conditions deficiencies may appear.

The soil pH is the single most important factor involved in micronutrient availability. When the soil pH is between 6.2-6.8, micronutrient deficiencies do not occur, except under very unusual circumstances. Unfortunately, more time is spent worrying about the exceptions than emphasizing the simplicity of pH adjustment.

Boron

Boron is the most widely used micronutrient fertilizer. It is relatively .nexpensive and can be easily added to N, P, K fertilizers during bulk blending. lowever, it is also the element most likely to accumulate to toxic concentrations. 3oron should only be applied where it is needed. Susceptible crops such as ;nap beans and soybeans are known to be injured by soil boron levels as low as ? ppm (HWS). Annual applications of boron can result in the accumulation of :oxic concentrations in poorly drained soils.

Unlike many other micronutrients, a soil test can be useful in predicting)oron deficient soils. Hot water soluble (HWS) boron levels less than 0.5 ppm ire considered critical for some vegetable crops. Table 2 lists the environ-iental conditions and crops most likely to develop a boron deficiency. Calcareous ;oils should be watched closely since boron deficiency is most often found in ılkaline soils.

TABLE 2. Boron Deficiency

Most Susceptible Crops	Environmental Conditions
Beets	high soil pH
Cauliflower	high soil calcium
Celery	well leached soil
Turnips	soil B less than 0.5 ppm (HWS)
Broccoli	

Fertilizer materials will vary widely in boron content (Table 3). Borax .s generally the most popular of the boron-containing fertilizers. For severe leficiencies, solubor can be dissolved in water and sprayed directly on the .eaves of plants. In addition, these materials can be applied with pesticide ;prays or added to liquid fertilizers for application to the soil. Band appli-:ations can be quite effective but also create the possibility of injury to 'oung seedlings of boron-susceptible crops.

TABLE 3. Boron Applications

Material	Form	Method	Amount/A*
Borax	10% granular	band or broadcast	10-30 lbs.
Borate 48	15% granular	band or broadcast	7-20 lbs.
Borate 68	21% granular	band or broadcast	5-15 lbs.
Solubor	20% powder	band or foliar	5-15 lbs.

*Use the low rate in sandy soils or if applied in a band at seeding. The high rate may be used to broadcast on calcareous soils.

Zinc

Although zinc deficiencies are most unusual, zinc assumes importance in Illinois due to extensive acreage of the two most susceptible crops, snap beans and sweet corn. Fortunately, both of these crops are primarily grown on dark prairie soils with a good deal of organic matter. Generally, two conditions must occur simultaneously to create a zinc deficiency. Both high pH and low organic matter are usually required before zinc deficiencies appear. This does not imply that all soils with pH greater than 7 and organic matter less than 1% will require applications of zinc. Table 4 lists crops and conditions under which a zinc deficiency may occur.

TABLE 4. Zinc Deficiency

Most Susceptible Crops	Environmental Conditions
Beans	high soil pH
Sweet corn	low soil organic matter
	cold, wet or compacted soil
	high soil phosphorus
	soil Zn less than 1 ppm (DTPA)

A zinc-phosphorus interaction has been observed in several plant species where high levels of one of these elements may reduce plant uptake of the other. This has resulted in undue attention given to high soil phosphorus levels. Although it has been demonstrated that large phosphorus applications can intensify an existing zinc deficiency, it will not create a problem when adequate zinc exists. Growers should only be concerned about high phosphorus when all of the other environmental conditions listed in Table 4 exist concurrently.

If it becomes necessary to supply zinc, a number of products and methods are generally available. The standard and least expensive is zinc sulfate. Zinc sulfate can be mixed with most fertilizers and incorporated into the soil. Banding or broadcasting without incorporation will be less effective due to the low mobility of zinc. Zinc oxide is also inexpensive but may not be available in calcareous soils. Chelated zinc is recommended when a band placement is desired, especially in calcareous soils. The chelates are more expensive but generally less is required than either zinc sulfate or oxide.

TABLE 5. Zinc Applications

Material	Type	Method	Comments
Zinc sulfate	inorganic	soil incorporated	inexpensive
Zinc oxide	inorganic	soil incorporated	inexpensive, not for calcareous soils
Sequestrene Zn	chelate	band or foliar	good soil availability
Hampene Zn	chelate	band or foliar	good soil availability
Silviplex Zn	organic	foliar or band	rapid foliar uptake
Claw-El Zn	organic	foliar or band	rapid foliar uptake

Soil application of zinc sulfate is the most common way of correcting deficiencies of this element. However, a foliar application will result in the most rapid correction of the problem. Unfortunately, the effect will be short-lived and further applications may be required at two week intervals. Growers are advised to make a single foliar application if it becomes necessary and then sidedress with zinc chelate if it is still early in the growing season. A more long-lasting broadcast application with zinc sulfate should be made the following spring. Two general classes of materials are available for making foliar applications, the chelates and the organic compounds. While chelates may be slightly less expensive, the organic zinc compounds may be absorbed by foliage better. Both, however, should be effective if used before the deficiency becomes severe.

Manganese

Manganese deficiencies in Illinois will almost always be associated with calcareous soil conditions. Beans are especially susceptible.

TABLE 6. Manganese Deficiency

Most Susceptible Crops	Environmental Conditions
Beans	high soil pH
Peas	poorly drained soils
Potatoes	excess iron

Manganese is generally supplied as manganese sulfate in a band at planting. Unlike zinc, manganese sulfate is soluble and, therefore, is mobil in the soil. Being soluble, it can also be used in foliar applications. The manganese chelates have also been used successfully as foliar applications. However, they have not proved as effective as manganese sulfate in the soil.

TABLE 7. Manganese Applications

Material	Type	Method	Comments
Mn sulfate	inorganic	band or foliar	inexpensive & effective
Mn oxide	inorganic	band	poor in calcareous soil
Sequestrene Mn	chelate	foliar	
Hampene Mn	chelate	foliar	
Silviplex Mn	organic	foliar	rapid foliar uptake
Claw-El Mn	organic	foliar	rapid foliar uptake

Iron

Iron deficiencies occur primarily in calcareous soils. Symptoms appear as interveinal chlorosis of the young leaves.

TABLE 8. Iron Deficiency

Most Susceptible Crops	Environmental Conditions
Beans	high soil pH
Broccoli	excess manganese
Spinach	
Tomatoes	

Diagnosis of iron or manganese is difficult because; 1) visual symptoms are similar; 2) they occur under the same conditions; 3) and both soil and plant analysis data are difficult to interpret. The problem of differenciating between iron and manganese deficiency could seemingly be avoided by applying both elements when either deficiency appears. However, a nutrient antagonism exists between these two elements, so that additional manganese can intensify iron deficiency and vice versa. The best solution would be to avoid the situation all together by adjustment of soil pH.

In situations where iron is known to be deficient, it can be banded at planting or sidedressed early with nitrogen fertilizer. Chelates should be used when iron is supplied to the soil as iron sulfate is rapidly oxidized to unavailable forms. Iron sulfate, chelates, or organic complexes can be used for foliar applications. Several applications may be required early in the season. Symptoms usually diminish as the season progresses due to an increase in plant roots and a better environment for microbial activity which releases available iron.

TABLE 9. Iron Applications

Material	Trade Name	Type	Method
Ferrous sulfate	--	inorganic	foliar
Fe DTPA	Sequestrene 330	chelate	foliar or band
Fe EDTA	Sequestrene NaFe	chelate	foliar or band
	Hampene Fe	chelate	foliar or band
Fe EDDHA	Sequestrene 138	chelate	foliar or band
Organic complexes	Claw-El	organic	foliar

Several different chelates are available for iron applications. The EDDHA chelate (Sequestrene 138) is the most desirable as it remains available in calcareous soils and is not phytotoxic when applied to the foliage. The organic complexes are also excellent for foliar applications.

Copper

Copper deficiencies occur primarily on organic soils and very acid sands. Mineral soils with less than 6 ppm DTPA extractable copper may also produce small onions with poor scale development.

TABLE 10. Copper Applications

Material	Type	Method	Comments
Cu sulfate	inorganic	soil or foliar	inexpensive & effective
Cu oxide	inorganic	soil	poor in calcareous soils
Sequestrene Cu	chelate	soil or foliar	good in calcareous soils
Hampene Cu	chelate	soil or foliar	good in calcareous soils
Silviplex Cu	organic	foliar	rapid foliar uptake
Claw-El (Black label)	organic	foliar	rapid foliar uptake

The most common material used to prevent copper deficiencies is the sulfate form. A single application of two to eight lbs/acre of copper on mineral soils should be adequate for several years.

J. M. Gerber is an Extension Specialist in Vegetable Crops.

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POTASSIUM MOBILITY IN MULCHED AND UNMULCHED PLAINFIELD SAND AND ITS EFFECT ON TOMATO YIELDS

John M. Swiader and John M. Gerber

Sandy soils, which comprise approximately 2 percent of Illinois, are easy to manage and are well adapted to mechanization. However, these soils usually have low cation-exchange capacities (CEC) and are subject to excessive leaching. As a consequence, the total and available potassium (K) contents of highly leached sandy soils are frequently too low for intensive vegetable production. Large amounts and several applications of fertilizer materials are often necessary to sustain economic yields of many vegetable crops.

Plastic mulches have been used to reduce loss of N by leaching in sandy soils (1, 3, 6). Application of black plastic might be a means of reducing the downward movement of K. The purpose of this study was to determine the mobility of K through the profile of a Plainfield sand over the course of one growing season and to evaluate the effectiveness of a plastic mulch in reducing K leaching and improving yields of tomatoes.

Materials and Methods

This study was conducted at the Illinois River Valley Sand Field at Kilbourne, Illinois. The Plainfield sand contained less than 1 percent organic matter and consisted of the following USDA textural analysis: 0.8% coarse sand, 70.5% medium sand, 27.3% fine sand, and .6% very fine sand and silt. The sand is excessively drained with rapid permeability and very low available water. Cation-exchange capacity was less than 3. Soil test levels for most nutrients were moderate to low. Nitrogen at 50 lbs/A and phosphorus at 200 lbs/A were broadcast and disked in prior to planting. Additional nitrogen of 50 lbs/A was sidedressed midway through the growing season. Other than K, all plots received uniform fertilizer treatments.

Four separate rates (0, 100, 200, 400 lbs/A) of potassium were applied as KCL. These were broadcast by hand prior to planting and rototilled to a depth of 6 inches. Within each level of K, half the research plot was put under a black plastic mulch. The experiment design consisted of a split-plot with the 4 levels of K as the main treatment plots and the black plastic mulch as sub-plots.

Tomato variety "Pik Red" was used as the indicator crop. Plants were started in the greenhouse and set in the field in late May. Overhead irrigation was used throughout the season. The plastic mulch was perforated with 2 inch diameter holes at 6-inch intervals within 8 inches of each outer side. In addition, tomato plants were placed in 4 inch diameter holes located in the middle of each plastic sheet. Plants were hand harvested in late August and early September. Soil samples were collected at 3 times during the season: early growth, mid-growth, and immediately after harvest. At each sampling time, soil was collected from 0-6, 7-18, 19-36, and 37-48 inch depths within the soil profile. Soil analysis was by atomic absorption and flame emission procedures.

Results and Discussion

The movement of K through the soil profile 3 weeks after application of 4 rates of KCl is shown in Table 1. Potassium movement was almost entirely restricted to the upper 6 inch soil layer. Downward movement of K was minimal. However, increasing the rate of K fertilizer to 400 lbs/A resulted in some K mobility to the 18 inch soil layer. This was expected due to the mass action effect from the large amount of applied KCl. The lower soil depths, 36 and 48 inches, showed little effect of K fertilization at this time.

For the same soil profile, but 13 weeks into the growing season, K was distributed throughout the upper 36 inches of soil (Table 1). Considerable K had leached from the plow layer into the lower depths in this highly drained sandy soil. There was a predominant movement of K out of the surface soil to a depth of 18 inches. The amount of K that still remained in the surface soil layer was in direct relation to the initial fertilizer rates. There was an increase of K in the 36 inch soil layer which became more pronounced as fertilizer rates increased. Soil analysis for the 48 inch layer showed no effect of K movement.

TABLE 1. Potassium Mobility in Plainfield Sand 3 and 13 Weeks After Application of 4 Rates of KCl.

	3 Weeks				13 Weeks			
Soil Depth	Applied K (lbs/A)				Applied K (lbs/A)			
(inches)	0	100	200	400	0	100	200	400
	Soil K (lbs/A)							
6	65	156	186	256	64	102	114	156
18	62	70	88	148	58	104	125	162
36	64	72	80	84	62	85	110	132
48	58	68	58	62	52	60	52	68
Total	249	366	412	550	236	351	401	518

It appears that in the course of a 13 week growing season K mobility in this sandy soil is mainly confined to a vertical distribution of approximately 30 inches. As the amount K fertilizer is increased, K nutrients move further down into the soil profile. For deep rooted vegetable crops, K mobility in sandy soils would not pose as severe a problem as for shallow vegetables. The relatively deep pattern of growth by roots would likely compensate for some of the downward movement of K fertilizer. However, it is possible that a shallow rooted vegetable might experience K deficiency symptoms, especially as the growing season progressed. It would therefore be necessary to increase the initial rate of applied K fertilizer or apply a mid-season sidedressing to maintain sufficient K levels in the upper soil layers for these crops.

TABLE 2. Effect of Black Plastic Mulch on Movement of Potassium in Plainfield Sand for 4 Rates of Applied KCl[z]

Soil depth (inches)	No Plastic Applied K (lbs/A)				Plastic Applied K (lbs/A)			
	0	100	200	400	0	100	200	400
6	64	102	114	156	72	148	179	276
18	58	104	125	162	63	142	175	192
36	52	85	110	132	51	54	74	91
48	52	60	42	68	50	48	62	59
Total	236	351	401	518	236	392	490	618

[z]Soil Sampled 13 weeks after fertilizer application.

The effect of plastic mulch on K movement after fertilizer application in a Plainfield sand is presented in Table 2. Plastic mulch resulted in more K in the upper soil layers. Potassium movement in the mulched soil was primarily restricted to the 0-18 inch soil layer. During that same period of time, K movement in the unmulched soil was observed down to the 36 inch soil zone.

TABLE 3. Influence of Potassium and Black Plastic Mulch on Yield of "Pik Red" Tomatoes in a Plainfield Sand, 1980

Applied K (lbs/A)	Total Marketable Yield (tons/A)	
	No Plastic	Plastic
0	6.3	7.2
100	11.5	14.2
200	20.4	24.3
400	22.3	25.4
Total	60.5	71.1

Plastic mulch increased yields for tomatoes (Table 3). This relationship suggests that higher tomato yields for mulched soils were possibly due to the increased levels of K in the upper soil layers (0-18 inches) where the roots of tomato plants tend to accumulate. Increased root development has been associated with the use of plastic mulch (4). It has been reported by others that moisture is the soil condition which was improved by plastic mulch (2,5). However, in this study, constant moisture was maintained by overhead irrigation and small differences in soil moisture were observed throughout the growing season.

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CONTROL OF VOLUNTEER HORSERADISH

M. C. Burke and H. J. Hopen

Horseradish is a perennial member of the Cruciferae. It is grown commercially as an annual for its fleshy taproot which, when ground with vinegar and salt or sugar, is served as a condiment with meat or fish.

The branch roots may grow deep. Robbins, in 1917, observed that the roots can penetrate 6-7 feet deep. If the entire root is not removed during harvest, that portion remaining may become a volunteer plant the following season. Volunteer plants also arise by branch roots breaking off during harvest. Seeds are not a factor in volunteer horseradish establishment.

In early 1977, the imported crucifer weevil (Baris lepidii Germar) was discovered feeding on horseradish in the East Saint Louis Area (ESLA). The shiny blue-black adults feed on and oviposit in tissues of primary and secondary roots. Upon hatching, the white grub-like larvae tunnel and feed inside the root. Harvested roots suspected of larval contamination may bring a reduced market value. The weevils overwinter as adults, hibernating in the soil or as eggs or larvae in the roots. The weevil is a weak flyer; only 1% of the males and 30% of the females have rudimentary wings that may sustain flight.

Horseradish in the ESLA is generally grown in a two-year rotation; horseradish one season and a rotation crop the next. The rotation crops most common in the ESLA are: sweet corn, soybeans, winter wheat, field corn, other crops (i.e., strawberries, snap beans, turnips, spinach, etc.)

Controlling volunteer horseradish during the rotation crop season should eliminate most of the insect's resting and feeding sites, thus causing a high mortality rate. The Integrated Pest Management System (IPM) which is proposed to control the imported crucifer weevil consists of 1) controlling volunteer horseradish, 2) insecticide treatment of sets to prevent nesting and feeding, and 3) monitoring weevil populations.

Three methods of controlling volunteer horseradish were evaluated: 1) discing, 2) herbicides, and 3) combination of discing and herbicides.

Discing was evaluated for three reasons: first, to dessicate many weeds; second, it is common practice to disc or plow in the ESLA; and third, to cut root segments into small pieces and induce sprouting in these segments.

The two criteria used to select herbicides were phytotoxicity to horseradish in a previous study, and ability to kill the entire plant, especially the root. Total plant kill is necessary, because even a small root piece can become a new plant.

The following herbicides and combinations were used in this research: 1) glyphosate (Roundup^R), 2) dicamba (Banvel^R), 3) atrazine (Aatrex^R), 4) 2,4,5-T, 5) dicamba, atrazine and oil, and 6) dicamba and glyphosate.

Optimal control of volunteer horseradish was achieved by a mid-September application of Roundup at 1 gallon per acre. Control was enhanced by discing 4-6 weeks prior to treatment. Banvel plus Roundup combination provided good control, but control was inferior to Roundup applied alone. In 1978, excellent control was obtained with 2,4,5-T. Due to the Environmental Protection Agency emergency suspension of this material, this aspect of the research was discontinued.

A planting depth study indicated that horseradish sprouted from depths of 1 to 3 feet and emerged by mid-September when planted in mid-May. Root regeneration data indicated that within 4-6 weeks after discing, the newly emerged sprouts would be tall enough to receive adequate herbicide coverage with Roundup. Greenhouse research concluded that Roundup is translocated into the roots, with root injury being observed.

Roundup applied in mid-September at 1 gallon per acre, 4-6 weeks after discing, should provide good control of volunteer horseradish in the East St. Louis Area.

AT THIS WRITING (OCTOBER 1, 1980) ROUNDUP IS NOT LABELED FOR THE USE OUTLINED IN THIS REPORT. ROUNDUP DOES HAVE A "ROOT CROP" TOLERANCE WHICH INCLUDES HORSERADISH. THE MANUFACTURER OF ROUNDUP (MONSANTO) HAS INFORMED US THAT A LABEL FOR THE USE OUTLINED HAS BEEN REQUESTED.

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EFFECTIVENESS OF SONALAN AND SEVERAL SLOW RELEASE FORMULATIONS OF AMIBEN FOR WEED CONTROL IN PUMPKINS ON SANDY SOILS

V. Raboy and H. J. Hopen

The soluble concentrate (SC) of chloramben (Amiben) is currently the only herbicide labeled for use in pumpkins in Illinois. Due to its high solubility in water and low soil adsorption, Amiben leaches readily on sandy soils. Chloramben methyl ester (Vegiben) has longer persistence on sandy soils, resulting in better weed control, although its performance can also be inconsistent from year to year.

Applying Amiben in slow release formulations, where small amounts of herbicide are released steadily into the soil solution, might increase its persistence in the top few centimeters of soil, thereby improving weed control. The U.S.D.A. Research Laboratory in Peoria, IL has developed a slow release formulation employing starch xanthide (SX) polymer matrixes. In this formulation the herbicide is physically trapped in little pockets in the polymer matrix, and is slowly released into the soil solution as the polymer matrix granule breaks down.

In 1979 and 1980, field trials were conducted to determine the effectiveness of various SX and commercial formulations of Amiben and Vegiben. In 1980, a tank mix of Vegiben and Hopkins polymer (HP), an experimental additive designed to increase persistence, and Sonalan herbicide (a dinitroaniline) were also evaluated.

In 1979 one SX formulation of Vegiben gave the best early season weed control, although not much better than commercial Vegiben. Weed counts in the 9th week indicated that no formulation of chloramben gave adequate season long control. Based on these results, it was decided to focus on formulations of Vegiben in 1980.

Sonalan provided excellent early and season long weed control in 1980. Although little difference among the Vegiben formulations was apparent, the commercial herbicide and HP tank mix applications provided the best control.

Summary. Laboratory studies show that SX entrapment reduces initial availability and increases long term availability of chloramben. At this point, SX formulations do not appear to have an advantage over commercial Vegiben. It is possible that other variables in the SX formulation procedure might be manipulated to obtain a more effective product. Sonalan appears to be an excellent alternative to chloramben for weed control in pumpkins on sandy soils.

Elanco Products, the manufacturer of Sonalan is currently pursuing a label for cucurbits which includes pumpkin.

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MDMV TIME OF INOCULATION STUDIES ON SWEET CORN YIELD

M. A. Mikel, Cleora J. D'Arcy, A. M. Rhodes, and R. E. Ford

Introduction

Maize dwarf mosaic (MDM) has caused significant yield loss in Illinois sweet corn. Yield loss is expressed as reduced weight, length, diameter, quality, and delayed midsilking of ears in addition to reduced plant height as a result of MDM infection (2). Maize dwarf mosaic virus (MDMV) is spread from infected plants to healthy sweet corn by aphids. In Illinois these aphid vectors become active in early summer. Fresh market and sweet corn for processing is planted routinely throughout the spring and early summer to extend the harvest season. The question arises as to how much yield loss results from different plantings to MDM when the disease becomes widespread in July; are losses greater on plants infected while young, or those infected when mature, or is there a difference? An earlier report has shown that yield loss was most severe when the sweet corn cultivar Gold Cup was infected at the seedling stage, with decreasing yield loss when infections occurred as the plants became more mature (1). This study was an expansion of the earlier work; here comparisons were made among plantings inoculated with MDMV at different times in the growing season.

Materials and Methods

This experiment was conducted at 2 locations; Urbana and Dixon Springs, Illinois, with planting dates May 28 and May 27, 1980 respectively. Field spacing was 38 inches between and 13 inches within rows of 25 plants each at Urbana, and 30 inches between and 13 inches within rows of 25 plants at Dixon Springs. At Urbana, 3 sweet corn cultivars were tested: Gold Cup, Golden Gleam, and BVX 819 (an experimental hybrid), and at Dixon Springs Gold Cup and Golden Gleam.

In 1978 (2), 'Gold Cup' was found to be susceptible to MDMV-strain B, and 'Golden Gleam' tolerant. A susceptible hybrid may show both mosaic leaf symptoms and severe blanking at the butt-end of the ear when infected by MDMV, whereas a tolerant hybrid may show only leaf symptoms with little or no butt-blanking. The experimental hybrid BVX 819 was included because it was believed to be either highly tolerant or resistant (no leaf symptoms or butt-blanking) to the virus.

Experimental design was a split-plot with cultivars as main plots and treatments as sub-plots, with 3 replications of main plots. The four treatments used were inoculated at the 3 leaf stage, the 8 leaf stage, just prior to silking, and a noninoculated control. Plants were mechanically inoculated with a 1:1 (v/v) mixture of MDMV strains A and B in .05 sodium phosphate buffer, pH 7.0 with 1% Carborundum added to aid inoculation. Plants were harvested at fresh market maturity.

Results and Discussion

All of the cultivars at both locations showed reduced yields from the first and second inoculations with little or no yield reduction from the third (Tables 1 and 2). In general the first inoculation caused the most severe yield loss with decreasing losses at the later inoculations. Under the conditions of this test, all 3 cultivars would have to be considered to be susceptible to MDMV for yield characteristics assayed.

The environmental conditions at Dixon Springs were hotter and drier than at Urbana. This additional stress at Dixon Springs apparently affected differences due to time of inoculation for the 2 cultivars. The plants were irrigated when Gold Cup was in silk but before Golden Gleam had silked, thus, Gold Cup was under more stress during the critical period of pollination than Golden Gleam.

From the results of these tests, it can be concluded that the earlier sweet corn is infected with MDMV, the greater the yield loss. Late plantings may show greater yield loss, since they will become infected at an early growth stage when the virus is widespread in early summer; in early plantings, the plants will be more mature and less likely to be adversely affected.

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Table 1. Effect of time of Inoculation of MDMV strains A and B on yield of 3 sweet corn cultivars, Urbana, 1980

Cultivar	Treatment[2/]	Days to Midsilk	Plant Height (cm)	Ear Characteristics[1/] Butt Fill (missing kernels)	Length (mm)	Diameter (mm)	Weight (grams)	Number of Second Ears
Gold Cup	1	57.0[a] [3/]	83[a]	19.5[a]	164[b]	44.2[ab]	165[ab]	0.7[a]
Gold Cup	2	53.3[b]	95[b]	12.4[b]	158[a]	42.4[a]	159[a]	8.7[b]
Gold Cup	3	53.0[b]	121[c]	4.4[c]	170[c]	44.7[b]	172[bc]	17.7[c]
Gold Cup	4	53.0[b]	124[c]	2.2[c]	171[c]	45.9[b]	179[c]	15.7[c]
Golden Gleam	1	64.3[a]	105[a]	33.7[a]	184[a]	42.9[a]	228[a]	0.0[a]
Golden Gleam	2	62.7[b]	126[b]	26.7[b]	185[a]	43.1[a]	229[a]	1.0[a]
Golden Gleam	3	62.0[b]	144[c]	21.6[bc]	199[b]	45.2[b]	260[b]	2.3[ab]
Golden Gleam	4	62.3[b]	156[d]	17.2[c]	202[b]	45.4[b]	269[b]	6.0[b]
BVX 819	1	58.7[a]	114[a]	18.8[a]	205[a]	45.3[a]	254[a]	0.0[a]
BVX 819	2	58.0[ab]	122[ab]	12.2[b]	215[b]	46.6[ab]	278[b]	0.0[a]
BVX 819	3	57.0[c]	126[b]	4.7[c]	227[c]	48.4[b]	305[c]	0.3[a]
BVS 819	4	57.3[bc]	130[b]	4.7[c]	230[c]	48.3[b]	301[c]	0.3[a]
LSD (.05)		0.9	11	5.3	5	1.8	12	4.0

1/ Data are means of 20 plants per sub-plot for plant height and 28 ears for other characters.

2/ Numbers represent inoculation treatments (sub-plots); 1 = 3 leaf stage, 2 = 8 leaf stage, 3 = just prior to silking, and 4 = noninoculated control.

3/ Comparison of treatments in columns within cultivars having no common letter significantly different at the 5% level with an LSD test. Experiment was a split-plot with cultivars as main plots and treatments as subplots, with 3 replications of each plot.

Table 2. Effect of time of inoculation of MDMV strains A and B or yield of 2 sweet corn cultivars. Dixon Springs 1980.

Cultivar	Treatment[2/]	Days to Midsilk	Plant Height (cm)	Ear Characteristics[1/] Butt Fill (missing kernels)	Length (mm)	Diameter (mm)	Weight (grams)	Number of Second Ears
Gold Cup	1	53.3[a3/]	99[a]	40.8[a]	151[a]	42.0[a]	149[a]	1.0[a]
Gold Cup	2	55.3[a]	96[a]	29.3[a]	161[b]	42.6[ab]	159[a]	2.0[ab]
Gold Cup	3	52.0[a]	138[b]	35.8[a]	161[b]	43.5[b]	163[a]	4.0[bc]
Gold Cup	4	52.0[a]	137[b]	40.2[a]	155[ab]	43.6[b]	154[a]	5.3[c]
Golden Gleam	1	60.0[a]	104[a]	59.6[a]	180[a]	41.9[a]	172[a]	0.0[a]
Golden Gleam	2	58.7[a]	105[a]	32.8[b]	180[a]	42.4[a]	188[bc]	1.3[a]
Golden Gleam	3	57.7[a]	131[b]	37.9[b]	185[ab]	42.8[a]	178[ab]	2.3[a]
Golden Gleam	4	57.3[b]	141[c]	21.9[b]	191[b]	44.9[b]	202[c]	1.3[a]
LSD (.05)		2.6	9	15.3	7	1.0	14	2.3

1/ Data are means of 12 plants per sub-plot for plant height and 15 ears for other characters.

2/ Numbers represent inoculation treatments (sub-plots); 1 = 3 leaf stage, 2 = 8 leaf stage, 3 = just prior to silking, and 4 = noninoculated control.

3/ Comparison of treatments within cultivars having no common letter significantly different at the 5% level with an LSD test. Experiment was a split-plot with cultivars as main plots and treatments as sub-plots with 3 replications of each plot.

JERUSALEM ARTICHOKES -- A POTENTIAL SOURCE OF ETHANOL FOR ILLINOIS?

C. M. Sabota

Jerusalem artichoke (Helianthus tuberosus L.) is an American sunflower, however, unlike the sunflower grown for its seed, the Jerusalem artichoke is cultivated for its tubers. The plant grows 6 to 12 feet tall and has many small flowers per stalk. The tubers contain no starch and are commonly utilized by diabetics (the carbohydrate in the tuber is in the form of inulin, a polysaccharide, which is hydrolized into fructose).

Many countries now use alcohol distilled from farm commodities as a source of fuel for automobiles. An alcohol-based fuel industry has several attractions. Automobile engines readily burn a gasoline/alcohol mixture containing up to 10 percent alcohol without adjustment. Commercial production of alcohol for industrial purposes is already a well-established industry, and the technology for converting plant materials into alcohol is widely dispersed throughout the world. Also, distilleries can be built in 6 to 24 months.

TECHNOLOGY

There are essentially two ways to obtain liquid fuels from vegetative matter: by extracting sap from plants that are naturally high in hydrocarbons or by converting plant materials into alcohol. Extensive research on plants that will directly yield a liquid fuel is under way. However, many ways to convert plant materials into alcohol (principally methanol or ethanol) already exist.

The conversion of forest products into methanol (wood alcohol) is attractive both because of its vast potential and because it does not compete for land which might otherwise be used to produce food. Methanol's disadvantages are that the technology is not as well-established as for ethanol.

Also its highly corrosive nature creates problems in current automobile engines. Production of ethanol, however, has the potential to compete for the world's cropland in a major way.

For centuries ethanol (ethyl alcohol) has been produced as an intoxicant from fruits and grains. Ethanol is obtained from three main categories of crops: sugar crops, such as sugarcane, sugar beets, and sweet sorghum; root crops, mainly cassava (also known as manioc); and the major cereals. It can be produced directly from sugar by fermentation or from starches and cellulose that are first converted to sugar and then fermented.

YIELD

Interest in Jerusalem artichokes for their potential value as a source of alcohol is already widespread. A grower in Washington has in production 35 acres of Jerusalem artichokes. He markets them as seed and for fresh market. He estimates that the tubers plus tops would yield the equivalent of 1000 to 1200 gallons of alcohol per acre.

Jerusalem artichoke yields in Davis, California, from small irrigated plots averaged 26.5 tons per acre of tubers in 110 days with a July 1 planting date.

This tuber yield is equivalent to about 600 gallons per acre of ethanol. Research conducted in Illinois in 1931 resulted in artichoke tuber yields of 10 tons per acre.

The highest alcohol content can be obtained by harvesting tops in the fall and tubers in the spring. The energy potential (calories) of fall harvested tubers can be as little as one-tenth that of the spring harvested crop.

BY-PRODUCTS

By-product values for fodder beet and Jerusalem artichoke may be expected to reflect the protein content of the pulp and stillage from the press juice (or starch hydrolysate) and be similar in value to sugar beets. But paramount is the increased protein concentration found within a crop after it has passed through the fermentation (press juice) process; protein concentrations increase two-fold in the grains and six-fold in sugar beet and Jerusalem artichoke pulp.

COST

Production costs of Jerusalem artichokes are minimal. It is usually only necessary to replant them every 4 years and they have few disease and pest problems. A Washington grower indicated that production costs would average $60 to $100 per acre per year.

If a minimal annual yield of 600 gallons per acre could be obtained the actual cost per gallon of alcohol would be about $.60. If then you subtract by-product credits and add manufacturing costs, the cost per gallon of alcohol would be $.80 to $1.10.

Our quest is to replace fossil fuels with renewable fuels. We need a system that provides a net gain in liquid fuels. Ethyl alcohol produced by fermentation of crops meets this objective if and only if: (1) minimum inputs are used in crop production (2) advance designs are used in the fermentation/distillation facility, and (3) biomass and other solar sources are used, as far as possible, to fuel the system.

Currently, barley, sugar beet, corn, and cull fruit and vegetables are used to make fuel alcohol. However, sweet sorghum, fodder beet and Jerusalem artichoke also seem to have potential as a source of ethanol. Jerusalem artichokes have a relatively low production cost per acre, a high by-product return, and a comparatively low alcohol cost per gallon. Illinois has a suitable climate and in most growing seasons sufficient rainfall for Jerusalem artichoke production.

C. M. Sabota is a graduate student in the Department of Horticulture.

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DO YOUR VEGETABLES HAVE MYCORRHIZA?

Walter E. Splittstoesser

The word "mycorrhiza" is used to describe a number of associations between fungi and plant roots. In contrast to the parasitic fungi-root association, mycorrhize do not result in disease symptoms and mycorrhiza are generally considered beneficial. Most vegetable plants have the fungi-root association (mycorrhiza) with the notable exception of the Cruciferae (mustard family which includes cabbage, radish, turnip, horseradish and others). Most plants do not have roots alone, instead they have mycorrhiza (mycorrhizal fungi plus root).

The type of fungi which infect vegetables are known as endotrophic mycorrhizal fungi. The hyphae penetrate the cells of the root cortex and are in contact with the soil by their individual hyphae or hyphal strands. They do not cause the plant root to change its shape. The fungi produce mannitol which inhibits plant enzymes from making insoluble carbohydrate. The carbohydrate stays soluble and moves into the fungus. About 10% of the carbohydrate produced by plants infected with mycorrhiza move into the fungus. In return, the plant receives a number of nutrients, notably phosphorus, from the mycorrhiza fungi.

The absorption of minerals by plants is dependent upon the absorbing capacity of the root and the movement of the minerals to the root. Highly mobile minerals such as potassium, nitrate, and sulfate are absorbed readily by the plant. Few feeder roots are needed for the plant roots to absorb adequate amounts of these minerals. Minerals such as copper, zinc and especially phosphate are slightly soluble and move little in the soil. Thus the number of feeder roots and mycorrhiza fungi influence the amount of these minerals absorbed.

Plant species differ in the number of roots and root hairs they contain. The cereals and grasses have an extensive root system which covers a large volume of soil. As such these plants usually show little response when infected by mycorrhizal fungi. Plants such as leeks which have few feeder roots, show a large increase in growth when infected. One of the main benefits of the fungi is hyphal growth into the soil, thereby increasing the soil volume which is explored for nutrients. The second major benefit is that the fungi are ten-fold more efficient than the plant roots in absorbing the nutrients.

All mycorrhizal fungi seem to be equally efficient in absorbing nutrients, transporting them to the plant, and increasing plant growth. Yet when introduced fungi are used, they often result in greater yields than that resulting from indigenous fungi. The reason for this is that plant growth is influenced more by the fungus-soil interaction than by the fungus-host plant interaction, as shown in Table 1.

Table 1. The effect of mycorrhiza upon the dry weight of onions grown in three soil types

Soil type	With fungus (dry weight - g/pot)	Without fungus
Agricultural	300	150
Forest	280	10
Alpine	60	20

There is a threshold value at which roots can absorb phosphorus; below this value no phosphorus is absorbed. Mycorrhizal fungi have a lower threshold value and are able to absorb phosphorus when the soil concentrations are so low that none is absorbed by the plant roots. Thus, rock phosphate, which is slowly soluble, can be used as a fertilizer on low phosphorus soils. The fungi do not solubilize the phosphorus but absorb that which is soluble. Mycorrhizal plants will utilize the phosphorus better than non-mycorrhizal plants but the soil phosphorus levels will decrease. This means that soils which are low in phosphorus will become very phosphorus deficient after 2-3 crops with mycorrhizal plants.

High levels of phosphorus inhibit endomycorrhiza infection of plant roots. Under these conditions, most plants do not become infected with mycorrhiza fungi. However, there is a large difference in plants due to myocorrhizal influence. One way to look at this is to determine the amount of phosphorus needed to replace the mycorrhiza fungi on the plant roots (Table 2). As many of our temperate soils have adequate phosphorus levels or are fertilized regularly, mycorrhizal infections have little impact.

Table 2. The amount of phosphorus needed by various plants without mycorrhizal fungus to equal the growth of similar plants with mycorrhizal fungus in low phosphorus soils.

kg/ha phosphorus needed	Plants
30	rye
60	corn, wheat, barley
100	onion, leek
130	strawberry
160	cassava
560	sour orange

Various agricultural practices influence the number of mycorrhiza fungi found in the soil. However, the fungi occur in nearly all soils -- world-wide.

If spring temperatures are cool or the fungi population is low, there may be little plant infection. Thus, plant growth may be poor at this time when phosphate needs are the greatest. Sterilization of the soil kills the pathogenic fungi, weed seeds and nematodes but it also reduces the population of mycorrhiza fungi. Their numbers may also decrease in the absence of suitable host plants during fallow periods. However, in England, after 20 years of continuous fallow, mycorrhizal fungi could be found, if suitable host plants were grown in the area.

Plants infected with mycorrhiza fungi are generally healthier and able to withstand transplanting shock easier. They also regenerate plant roots faster and are thus able to withstand periods of drought easier. If roots are damaged by nematodes or cultivation, the undamaged part of the mycorrhizal root system can compensate for some of this loss. In most cases, the mycorrhizal root is resistant to fungal pathogens. Mycorrhizal hyphae penetrate decomposing organic matter in the soil, such as corn and bean trash, and are able to compete with other soil microorganisms for the nutrients which are released.

At present, endomycorrhizal fungi cannot be grown in pure culture and are not available commercially. However, transplanted vegetables can be grown in mycorrhizal infected soil and transferred into a non-infected field. Alternatively, the soil and plant-roots from the mycorrhizal infected plants could be used. The roots are cut up and the roots, fungi and soil can be added to the sterilized areas as an inoculum.

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DISCOVERY OF NEW CHLOROPHYLLS IN NATURE

C. A. Rebeiz

Photosynthesis is a complex process that involves the collection of light energy at many points in green plant cells and conducting that energy to specific chlorophyll centers, called "reaction centers". In the reaction centers, the energy of the light excites special chlorophylls that in turn remove electrons from water in a still incompletely understood way.

It is the energy of these water electrons that is eventually converted via a series of complex steps into chemical energy and food. It is this food that makes all life possible on this planet.

Plant scientists have assumed since the beginning of the 20th Century that only one chemically distinct chlorophyll a and one chlorophyll b occurred in nature. It was believed that these two chlorophylls combined in different ways with fats and proteins in plant-cell membranes during photosynthesis to convert solar energy into food. We have recently discovered that there are more chemically different chlorophylls in green plants than previously known, each with a specific function.

The objective of our present research is the complete understanding of the structure, biosynthesis and function of the newly discovered chlorophylls. Hopefully this may bring closer the day when it will be possible to develop man-made photosynthetic membranes that are more efficient than plants in the conversion of solar energy, water and carbon dioxide into food. Furthermore, it may be possible to breed plants containing more of the useful (reaction center) chlorophylls than the less useful (antenna) chlorophylls which in turn will result in enhanced plant productivity.

C. A. Rebeiz is Professor of Plant Physiology, Department of Horticulture.

A SUMMARY OF RESEARCH ON PLANT CARBOHYDRATES AND RELATED COMPOUNDS

David B. Dickinson

There are several ongoing projects concerned with carbohydrates because of their important roles in plant growth, seed storage materials, and edible quality of horticultural products. The work on carbohydrates and growth should provide us with basic information as to how plant cells make new cell walls, giving us a better idea how to control growth. The most recent work in this area reveals that a sugar-inositol compound (probably glucose-inositol) is made in growing plant cells, and this compound may be a precursor of cell wall polysaccharides. We hope to isolate large enough quantities of this material to determine its structure, learn whether it has growth-promoting properties, and whether chemically modified versions of the naturally occurring compound are selective growth inhibitors.

Work on sweet corn sugars and related compounds is proceeding in collaboration with Professor A. M. Rhodes and graduate student E. Carey. We recently discovered that developing corn seeds contain sorbitol, a chemically reduced form of the sugar glucose. Sorbitol has a sweet taste. However, in the corn varieties tested so far, there is not enough sorbitol to contribute appreciably to sweetness. What is the function of sorbitol in developing sweet corn seeds? There is no answer yet. Some trees (apple, plum, apricot) move their photosynthetically fixed CO_2 in the form of sorbitol from leaves to the fruits. So sorbitol might be a translocated form of carbon in corn plants. Sorbitol might also have some protective role related to the ability of the seeds to withstand drying. Future research should answer these questions. Other research concerns the <u>sugary enhancer</u> gene which increases corn sucrose and greatly increases the sweetness of corn at the eating stage (1). Our recent work (Carey, Rhodes and Dickinson, unpublished data) shows that this trait can be transferred from one genetic background to another without loss of the high sucrose trait. Therefore, it should be feasible to transfer this gene into commercial sweet corn varieties.

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David B. Dickinson is Professor of Plant Physiology in Horticulture

BAITS OF DRIED BITTER CUCURBIT FRUIT FOR THE CONTROL OF CORN ROOTWORM ADULTS

Robert L. Metcalf, A. M. Rhodes and Esther R. Metcalf

Recently we reported (Rhodes et al 1980) that fruits of two hybrid species of Cucurbita, Cucurbita texana x C. pepo and C. andreana x C. maxima combined the genetic production of the bitter cucurbitacin terpenoids of the wild parents with the high yields of squash fruit characteristic of the domestic cultivars. The C. pepo x C. texana hybrid fruit contained about 0.48 mg cucurbitacin E and its glycoside per g fresh weight and the C. andreana x C. maxima fruit contained about 1.26 mg cucurbitacins B and D per g fresh weight. These cucurbitacins are arrestants and feeding stimulants for the corn rootworm beetles Diabrotica virgifera, D. undecimpunctata, and D. longicornis and attract the beetles in amounts as small as 1 nanogram (Metcalf et al 1980a).

Experiments in 1979 with cut fruit of the two hybrid bitter squash treated with about 0.1g of the contact insecticides methomyl or trichlorfon remained attractive to the beetles for at least two weeks and killed thousands of beetles. (Metcalf et al 1980b). Such baited fruit placed in infested corn fields attracted and killed substantial numbers of corn rootworm beetles.

During the 1980 season, we explored the use of these dried and ground hybrid Cucurbita fruits as broadcast granular baits poisoned with methomyl at 0.1% and decamethrin and fenvalerate at 0.01%, for the control of adult corn rootworm beetles. Dosage rate in experimental plots of sweet corn were 10, 30, and 100 lb. of dried ground bait per A. Pretreatment counts of corn rootworm beetles were estimated by examining 50 corn plants per 0.01 A. plot. The poisoned baits were broadcast by hand as evenly as possible through the rows of corn. All dead and moribund beetles were counted on the ground at 20 hours after treatment.

The results showed that the C. texana x C. pepo fruits produced a more attractive bait than the C. andreana x C. maxima fruits. This may be due to the better physical properties of the fibrous "zucchini" type fruit. The C. texana x C. pepo bait poisoned by 0.1% methomyl killed approximately 60,000 western and southern corn rootworm adult beetles per A. by 20 hours after application at 30 lb/A. (13.5g methomyl), approximately 85% of the pretreatment population. At a dosage of 10 lb/A. (4.5g methomyl), the reduction was about 62% of the pretreatment count. Bitter cucurbit baits containing decamethrin at 0.05% killed large numbers of corn rootworm beetles at dosages of insecticide ranging from 0.45-1.35g per A. The dried baits remained effective in killing beetles for 2 weeks or more.

The promise shown by these preliminary experiments suggests that granular baits of the dried bitter Cucurbita hybrids may play a useful role in controlling corn rootworm adults in corn and squash plantings without heavy use of insecticides. Many technical problems need additional study and will be investigated in subsequent seasons. We are endeavoring to produce higher yielding genotypes of bitter Cucurbita, to refine the production of granular poisoned bait, and to investigate suitable means of distribution. Larger scale field tests are planned for the 1981 season.

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Robert L. Metcalf is Professor of Entomology and A. M. Rhodes is Professor of Plant Genetics.

CONCENTRATIONS OF CADMIUM IN VEGETABLES GROWN IN CHICAGO GARDENS

T. R. Peck and J. M. Gerber

Municipal sewage sludge has been used as a soil amendment in many gardens throughout Illinois. Although sludge is known to provide valuable nutrients and improve soil structure, its use cannot be recommended due to concern over the potential health hazard from heavy metals in sludge amended gardens. This study was designed to survey Chicago gardens and examine the relationship between soil cadmium and plant uptake in garden vegetables.

Preliminary Survey

During the spring of 1979 soil samples were collected from 61 gardens in the Chicago area. Some of these gardens had been treated with varying amounts of municipal sewage sludge. These samples were analyzed for cadmium, lead, acidity, phosphorus, potassium and soluble salts. The 1 N HCl extraction procedure is expected to remove nearly the total amount of cadmium present in the soil.

A frequency distribution of the soil test cadmium levels indicated two populations. Those gardens receiving no sludge had cadmium levels less than 5 ppm. Sludge amended gardens had cadmium levels exceeding 5 ppm and ranging from 5.5 ppm to 103.5 ppm. Clearly sewage sludge applications had increased soil cadmium levels above that considered a normal background level. The question remained whether vegetables grown on these soils would accumulate additional cadmium in the edible portions.

Methods

Investigators returned to the gardens in the initial study and collected both plant and soil samples. The soil was collected from the rooting zone of the plant being sampled. The fresh plant samples were washed or peeled in the manner in which they would ordinarily be consumed. They were frozen and stored until they could be oven-dried at 80° - 90° C, ground in a Wiley mill and analyzed for cadmium by atomic absorption.

Results

Plant concentrations of cadmium (dry weight basis) were presented in Table 1. Collards, lettuce and beet tops (including Swiss chard) had high cadmium levels in the edible portions. Fruit crops such as cucumber, squash, tomatoes and peppers had the least cadmium in the edible portion.

Table One. CADMIUM CONCENTRATIONS (ppm) IN THE EDIBLE PORTIONS OF CHICAGO GARDEN VEGETABLES

Crop	No. of Samples	Mean Cd	±S.E.	Number of Samples[1] with Cd 1.0	Cd 2.0
Collards	10	4.0	1.6	8	4
Lettuce	12	3.7	1.5	9	7
Beet tops	21	3.4	1.0	17	12
Beet root	19	1.8	0.4	10	5
Onions	12	1.7	0.9	7	1
Ripe tomato	14	1.6	0.5	7	2
Carrot	13	1.3	0.4	5	2
Pepper	22	1.2	0.1	13	1
Green tomato	35	1.0	0.1	14	4
Bean	34	0.9	0.1	10	4
Squash	10	0.7	0.1	2	0
Cucumber	16	0.7	0.1	4	0

[1] Cadmium levels greater than 1 ppm (dry weight basis) are generally regarded as above the level that should be consumed in a steady diet of the vegetable.

In order to use soil test results as a predictor of cadmium uptake by plants, there must be some relationship between soil and plant concentrations. Table 2 presents the correlation coefficients (R^2) for soil test cadmium vs. cadmium in the edible portion of vegetables. There was little relationship between soil and plant cadmium concentration.

Table Two. REGRESSION COEFFICIENTS FOR VEGETABLE CROPS WITH PLANT CADMIUM AS THE DEPENDENT VARIABLE AND SOIL CADMIUM AS THE INDEPENDENT VARIABLE[1]

Crop	R_2	Crop	R_2
All crops	0.19	Green tomato	0.28
Greens only	0.29	Pepper	0.42
Fruit only	0.04	Carrot	0.61
Beet tops	0.80	Beet roots	0.82

[1] R^2 values of close to 1.0 would indicate a good relationship and a valuable test.

Discussion

Leafy green vegetables are thought to accumulate more cadmium than either fruit or root crops in the edible portion. This study confirms that observation.

Previously it was recommended that vegetables not be consumed if soil test cadmium levels exceed 5 ppm. The 5 ppm soil test level separates sludge amended gardens from those not receiving sludge. This recommendation implies that a relationship exists between soil test levels of cadmium and plant uptake. Unfortunately, other factors such as the chemical form of cadmium, pH, soil phosphorus, soil zinc, plant type and growth rates will also affect the accumulation of cadmium in the plant. Studies have shown that a relationship exists between soil and plant cadmium when the only variable is soil cadmium level. Given a single crop grown at one location, the soil test for cadmium may have some value. However, when many soils, crops and garden practices were examined, there was no meaningful relationship between soil and plant cadmium. In fact, 44% of the samples of leafy greens were grown on soils with less than 5 ppm cadmium, yet had greater than 1 ppm in the edible portion. Clearly the 5 ppm soil test level recommendation is misleading. Studies need to continue in order to find a soil test that better predicts plant uptake.

Gardeners that have applied municipal sewage sludge are recommended to incorporate the sludge thoroughly. Mixing the sludge deep in the soil will result in a dilution of available cadmium in a greater volume of soil. Also soils should be limed to pH 7.0 and fertilized with phosphorus to reach soil phosphorus levels (P_1) over 100 lbs/acre. High pH and soil phosphorus are thought to reduce plant availability of cadmium. Gardeners are further advised not to grow leafy green vegetables in areas that have received sludge applications within the previous three years.

1980 EARWORM CONTROL ON SWEET CORN

Roscoe Randell

Various insecticide treatments were applied to single row plots of late planted sweet corn, var. 'Gold Cup'. The plots were located at the University of Illinois Vegetable Crops Research Farm in Urbana.

Five applications of each insecticide treatment were made during the 12 day period following silk emergence. Approximately 35 gallons/acre of finished spray were applied with two nozzles on either side of the treated row.

Twelve days after the last application, four, 25 ear samples were examined for degree of worm damage and number of worms (see table). Since the plots were checked 24 days after the first silk (following the 12 day spray period plus 12 days between the last application and harvest), many earworms had matured and migrated from the ear tips into the soil to pupate.

AC222, 705, Larvin, Larvin and Sevin, as well as Lorsban and Sevin performed as well as Lannate. Sevin and methomyl (Lannate or Nudrin) are the only insecticides in the trial which are labeled for sweet corn worm control at present.

Very little European corn borer damage was found in either the treated or untreated plots.

Roscoe Randell is an Associate Professor of Agricultural Entomology

1980 CORN EARWORM CONTROL IN SWEET CORN
UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS

Location: Vegetable Crops Farm, Urbana
Plot size: Single row, 1/60 acre, with border row between plots
Variety: Gold Cup
Planted: July 6, 1980
Application dates: August 23, 25, 27, 30, September 2
Harvest date: September 12

Treatment and formulation	Rate a.i./a.	No. of worms/ 100 ears on 9/12			% Tip dam.[1]	% Ears free of damage on		Damage - 9/12		
		small	med	large	w/o worms	9/2[2]	9/12[3]	tip	side	both
Lannate 1.8L	0.45	54	5	2	10	88	57	30	4	9
AC222, 705 2,5E	0.1	34	18	4	19	77	47	36	2	13
Sevin 80S	2.0	16	8	13	28	59	43	38	9	13
Larvin 4E	0.45	24	28	4	23	73	40	44	4	12
Larvin 4E	0.75	16	-	6	31	63	49	40	3	8
Larvin 4E + Pounce 3.2E	0.225 + 0.05	19	2	7	28	65	48	35	2	13
Larvin 4E + Sevin 80S	0.225 + 1.0	11	8	3	27	70	57	34	2	7
Lorsban 4E + Sevin 80S	0.5 + 1.0	40	6	5	17	78	55	35	2	8
Pounce 3.2E	0.1	19	11	4	29	67	42	39	6	13
Nor-Am SN-72120 50W	0.5	30	18	14	36	55	14	58	2	26
Untreated	-	9	37	54	18	27	1	21	4	74

[1]Percent of ears with tip damage but no worms present.

[2]Calculated from the number of ears exhibiting large worms plus those with tip damage and no worm present on 9/12.

[3]Actual count of damage free ears on 9/12.

1980 CORN EARWORM CONTROL WITH BOLSTAR AND LANNATE

C. C. Doll

Location: Collinsville, IL
Planting date: June 7
Variety: H-445
Harvest date: August 10
Treatment dates: Lannate - 7/20, 21,22, 23, 24, 25, 26, 27, 7/28, 29, 30
Bolstar - 7/22, 24, 25, 26, 27, 29, 31, and 8/3
Application method: Bolstar by ground - 40 gallons of water per acre, Lannate by air - 5 gallons of water per acre.

Treatment	Rate a.i./A.	Earworms/100 ears small	Earworms/100 ears large
Lannate 1.8L	0.45 lb	12	1
Bolstar 6E	3/4 lb	10	0
Untreated	-	44	14

C. C. Doll is an Area Adviser, Fruits and Vegetables, University of Illinois.

EFFECT OF PLANTING DATE ON YIELD OF PROCESSING CARROTS GROWN ON SANDY SOIL

L. R. Nelms and H. J. Hopen

Midwestern production of processing carrots occurs mainly on the muck soils of Wisconsin and Michigan. Harvesting of carrots in this area is done in September and early October so packing of carrots by processors must either be delayed until this time or carrots must be shipped in from other states. This raises the possibility of producing carrots in Illinois where they can be planted and harvested earlier, especially on the well-drained sandy soils. In 1978, researchers at the University of Illinois Illinois River Valley Sand Field and commercial growers of carrots in Mason County showed that yields of 10 tons per acre were attainable by August 1, 15 tons by August 15, and 20 tons by September 1 (1). From this data, it was hypothesized that higher yields could be achieved by planting earlier than the 1978 planting dates of April 14 to April 25. The 1980 study tested the effects of two planting dates, March 28 and April 17, on the yields of processing carrots harvested in early and mid-August.

Methods

Cultivar: Danvers 126
Planting: First planting = 28 March, second planting = 17 April; 20" rows; used Planet Jr. seeder, hole #8. Stand thinned in both plantings on 17 June.
Plot: Main plot (planting date) = 40" x 30', subplot (harvest date) = 40" x 10'; 3 replications.
Fertilization: 40-40-160/A preplant incorporated; 25-0-0/A as NH_4NO_3 applied as sidedressing on 2 May (first planting only), 16 May, 28 May, 6 June, and 19 June (second planting only).
Weed control: 0.75 lb aia of Treflan, PPI.
Irrigation: 2.4"/April in 10 applications, 1.9"/May in 7 applications, 7.75"/July in 11 applications, 0.75"/August in 1 application.
Harvest: one subplot in each mainplot harvested on August 1 and August 14.

Results and Discussion

On each of the two harvest dates, yields from carrots planted on March 28 were greater by 3 tons per acre than yields from carrots planted on April 17, although these differences were not statistically significant (Table 1). Mean root weights, diameters, and lengths were also greater in carrots planted earlier, however, these differences again were not statistically significant. More replications in the experiment would have helped determine if these differences were, indeed, real and not due to some experimental error.

No differences in yields occurred from August 1 to August 14 in both planting treatments, but this may have been due to the lower number of plants in samples taken on August 14. Measurement of roots did reveal a slight increase in the growth of individual carrots from August 1 to August 14, but these differences were not statistically significant.

TABLE 1. Effect of Planting Date on Carrot Yield and Carrot Size

Harvest	No. plants per 10'	Root Yield Tons/Acre	Mean Root.Wt. Lb.	Mean Root diameter Cm.	Mean Root Length Cm.
1 August Planting					
28 March	72.0a[1]	10.5	0.11	2.9	11.5
17 April	59.3 b	7.2	0.09	2.6	9.9
14 August Planting					
28 March	54.7	10.1	0.14	3.1	12.5
17 April	52.0	6.8	0.10	3.1	10.9
	NSD	NSD	NSD	NSD	NSD

[1]Statistically significant by an analysis by Variance at 5%.

Mid-August yields of carrots planted on April 17 in 1980 were less than half of the yields of carrots planted on April 14 in 1971 and 1978 (Tables 1 & 2). The low 1980 yields are probably attributable to the low population density and high summer temperatures (Tables 1 & 3). Since the carrot root sizes were approximately equal in 1978 and the later planting in 1980, higher stands in 1980 might have resulted in higher yields. The same comparison can be made between the earlier planting in 1980 and the 1971 planting (Tables 1 & 2). It is difficult to make such conclusions from the stand and yield data because of the possible interactions between plant density and temperature. Carrots grown at the same density may not yield the same from year to year because of temperature differences. Temperatures above the optimum range of 60° to 70°F. retard carrot growth and reduce yield. The summer temperatures in the sandy area of west-central Illinois may limit the feasibility of growing carrots for early to mid-August harvests. This study indicates that planting earlier may help to increase these early yields, but more research is needed to determine how important the planting date can be.

TABLE 2. Carrot[1/] yields in 1971 and 1978, U. of I. Sand Field

Year	Planting Date	Harvest Date	Stand Plants 10 ft.	Total Yield Tons/A	Mean Root Wt.(Lb.)	Mean Root Length (In.)
1971	Apr. 14	Aug. 16	73	15.1	0.14	--
1978	Apr. 14	Aug. 14	114	15.7	0.09	4.2

[1]Danvers 126

TABLE 3. Mean Air Temperatures (°F) at U. of I. Sand Field

YEAR	MAY	JUNE	JULY	AUGUST
1971	59.3	77.6	71.7	72.2
1978	--	72.7	77.0	72.2
1980	65.4	72.7	81.1	79.2
MEAN				
1969-1980	62.1	71.6	75.8	73.4

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VEGETABLE CULTIVAR TRIALS - 1980

J. W. Courter and J. M. Gerber

Vegetable varieties were evaluated for yield and quality factors at several locations in Illinois (Figure 1). Varieties that perform well over several years or at more than one location are adaptable to a range of environmental conditions. This is a report of cultivars evaluated in 1980 at several locations in Illinois.

<u>Methods</u>

Emphasis in 1980 was on sweet corn (Tables 1-7), melons (Tables 8-9), peppers (Table 10) and tomatoes (Tables 11-15). Specific cultural practices are outlined with each table of results. Generally, 1980 provided an excellent opportunity to observe varietal performance under a wide range of temperature and rainfall extremes.

Dixon Springs Agricultural Center, Simpson, (Pope County): The southernmost Horticultural Research facility is located on Grantsburg silt loam. Rainfall from April through August was 6.00 inches under normal. The daily mean air temperatures were 10°F. higher than normal during most of July and August. Even with irrigation, essential for crop production, fruit set and quality were reduced under the high temperature stress.

Figure 1. Counties (shaded) where 1980 vegetable cultivar trials were conducted.

Illinois River Valley Sand Field, Kilbourne (Mason County): The Plainfield sand at the farm has an organic matter content of less than 1%. This soil is excessively drained, having rapid permeability and a very low water and nutrient holding capacity. Frequent irrigation and sidedressing of nitrogen fertilizer are required. Specific temperature and rainfall data are available in the 1980 Progress Report (4).

Urbana Vegetable Research Farm (Champaign County): The farm is located on a Drummer silty clay loam with an organic matter content exceeding 5%. It is somewhat poorly drained but has a good water and nutrient holding capacity. Soil test results for potassium range between 300-400 lbs/A and the P_1 test generally exceeds 100 lbs/A.

On farm trials were conducted in commercial fields in Union, Madison, Kane, and Will Counties.

Results

The yields of various vegetables are presented in table form (Tables 1-15). For comparison with previous years, see the Proceedings of the Illinois Vegetable Growers Schools (1,2,3,4). Trial results should not be mistaken for recommendations. Several new cultivars were found to be worthy of grower testing.

Tomato: Duke, Count, Royal Flush, Show Me
Pepper: Hybelle
Muskmelon: Ball 1776 (northern Illinois), Star Trek, Summet (early)
Sweet corn: Florida Stay Sweet, Penn Fresh, Bellgold, Earliqueen
Late sweet corn: Capitan, H-445, VX-749
Bicolor sweet corn: Burgundy Delight, Sweet Sal, BiQueen
Watermelon: All Sweet

Processing tomato cultivars and breeding lines were evaluated in 1980 for the first time at Kilbourne. The trial was part of a regional evaluation program. Several lines looked promising for Illinois (Table 15).

J. W. Courter and J. M. Gerber are Extension Specialists in Vegetable Crops.

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TABLE 1. PERFORMANCE OF SWEET CORN CULTIVARS, REPLICATED TRIAL, 1980[1]

Dixon Springs Agricultural Center

C. M. Sabota and J. W. Courter

Cultivar	Source[2]	Days	Yield[3] No.	Yield[3] Mkt.	Plant[4] Stand	Ear Characteristics[5] Wgt.	Length	Dia.	Husk	Tip	Blank
				(%)		(lbs)	(cm)	(mm)			
XP 1800	SU	57	5.0	0	9.3	1.5	19	38	7.4	4.0	1.0
Sundance	H	60	8.9	79	9.9	2.0	17	42	8.9	9.4	6.9
Reliance	SU	64	9.7	72	10.0	2.0	19	41	7.7	6.7	5.9
Gold Cup	H	67	13.5	83	9.7	2.2	18	42	8.0	8.2	8.9
NK 51036	DM	67	7.0	64	7.0	2.5	22	41	5.2	6.7	7.4
Golden Cross Bantam	DM	67	8.7	81	9.4	2.6	23	41	5.7	8.0	7.7
A-118	H	67	11.4	97	9.5	2.2	19	44	9.4	9.0	9.0
Bellringer	H	67	11.4	69	10.0	2.5	19	44	10.0	8.5	6.7
Bonanza	DM	67	7.5	69	8.2	2.3	23	44	10.0	6.5	6.4
Salute	DM	67	6.5	46	9.0	2.6	20	44	6.2	6.5	6.7
Commander	DM	68	7.7	61	9.2	3.0	24	45	5.2	6.7	7.2
Sugar Loaf	DM	68	9.6	86	8.8	2.6	20	43	7.4	7.2	8.2
Jubilee	DM	69	9.1	46	9.5	2.9	23	45	2.9	6.4	5.2
Apache	DM	70	9.2	91	9.0	2.5	20	43	9.5	9.4	7.5
Style Pak	DM	73	5.5	82	9.5	2.3	22	39	6.2	8.4	7.2
Silver Queen	DM	73	7.9	85	9.2	2.2	20	38	8.7	7.4	7.9
Iobelle	DM	74	9.5	84	9.9	2.7	20	45	8.7	8.2	7.7
Illinois 13	DM	76	6.9	42	7.7	2.6	20	43	6.5	5.9	7.2
Rogers Early Cogent	DM	76	7.3	62	6.7	2.3	19	43	10.0	7.3	7.0
Midway	DM	76	6.3	58	9.4	2.7	20	44	7.2	6.7	6.4

[1]Data are means of six replicates of pydrin treatments. No observed injury to pydrin occurred with 10 applications of 2X and 4X rates in this phytotoxicity study. We acknowledge Shell Chemical Company who supported this work.

[2]Source: DM = Del Monte, H = Harris, SU = Sun Seeds

[3]Yield: average number of ears harvested in once over harvest and the percent marketable ears.

[4]Plant stand: average number of plants per plot planted May 28, 10 plants per plot.

[5]Measurements for five husked ears for weight, length and diameter. Ratings from 0 (poor) to 10 (perfect) for -

Husk protection: 10 = complete, tight cover

Tip fill: 10 = complete fill

Blank: 10 = no missing kernels or blanking on ear

TABLE 2. PERFORMANCE OF SWEET CORN CULTIVARS
SINGLE ROW OBSERVATION PLOTS, 1980

Dixon Springs Agricultural Center
C. M. Sabota and J. W. Courter

Cultivar	Source	Days	Yield No.	Yield Mkt.	Plant Stand	Ear Characteristics Wgt.	Length	Dia.	Husk	Tip	Blank	Notes
				(%)		(lbs)	(cm)	(mm)				
White Sunglow	MU	60	6	50	10	1.4	18	18	4	8	6	White
Earlibelle	H	60	8	88	8	2.0	18	21	5	8	7	
Early Sunglow	MU	61	10	90	10	1.7	17	19	4	8	8	
Debut	R	61	7	0	9	1.7	18	19	2	8	5	
Aztec	A	62	9	78	9	2.1	18	20	8	6	8	
Reward	R	62	10	10	10	2.1	19	21	7	6	4	
Bellgold	H	65	10	100	10	1.8	17	19	9	8	9	
Golden Cross Bantam	BUR	65	4	25	9	1.5	19	17	10	6	6	
XP 925	AG	65	10	90	10	2.2	20	23	8	9	8	
Cr 7905	CR	66	7	29	8	2.7	23	22	5	5	8	
Earliqueen	R	66	9	100	10	2.5	20	23	7	8	8	White
XP 253834	A	66	12	97	10	1.9	18	21	5	10	8	
Kandy Korn	MU	66	10	0	10	2.5	21	21	0	5	7	
XP 2548W42	A	66	10	70	10	3.2	24	22	7	6	6	White
Guardian	A	67	9	67	10	2.8	24	22	8	7	6	
Cherokee	A	67	8	100	10	2.3	21	21	10	9	9	
Gold Cup	H	67	13	77	9	2.2	18	22	10	9	8	
Cr 7940	CR	67	9	0	10	3.0	29	21	5	5	6	
VX 709	H	67	8	100	9	2.5	19	22	3	9	8	
XP 2539	A	67	11	46	10	3.2	25	23	6	7	9	
XP 2532	A	67	9	45	10	2.5	20	22	2	8	8	

- more -

Performance of Sweet Corn Cultivars, DSAC, 1980 - 2

Cultivar	Source	Days	Yield		Plant	Ear Characteristics						Notes
			No.	Mkt.	Stand	Wgt.	Length	Dia.	Husk	Tip	Blank	
				(%)		(lbs)	(cm)	(mm)				
VX 719	H	67	8	63	10	2.5	21	21	8	8	6	
Banner	R	68	9	56	10	2.5	21	22	10	6	8	
Cr 7906	CR	68	9	78	10	2.3	18	21	9	9	10	
Snow Cap	AG	68	7	72	10	2.7	21	22	3	9	8	White
XP 2500	A	68	8	75	10	2.5	21	21	5	7	6	
XP 705	AG	68	7	0	9	2.0	17	20	9	8	4	White
Cr 7903	CR	68	9	22	10	3.0	21	22	6	2	6	
XP 2527	A	69	9	22	10	2.5	23	22	8	5	5	
White Lighting	CR	69	10	60	10	2.5	22	21	5	5	6	White
Comet	A	69	7	100	10	2.7	23	22	4	8	9	White
XP 5641	SU	69	9	45	10	2.3	22	22	6	7	5	
XP 5651	SU	69	9	0	10	2.2	22	20	5	2	5	
XP 5133	SU	69	10	0	10	2.5	20	22	6	4	6	
VX 749	H	69	7	0	10	2.4	25	20	4	7	5	
Cr 7902	CR	70	7	43	9	3.0	26	21	3	3	6	
Candystick II	BUR	71	6	83	9	1.4	24	15	10	7	7	
Honeycross	SU	72	8	63	7	2.5	23	21	6	7	8	
Golden Queen	R	74	10	40	10	2.2	21	22	6	6	6	
Mainliner	MU	74	10	70	10	2.2	21	20	7	8	7	
Tendertreat	MU	75	9	56	10	2.3	23	41	9	8	7	White

Planted: 5/28/80
Early harvest: July 27
Late harvest: August 10
Silk period: July 10 - July 20
Maturation: July 20 - August 10

TABLE 3. 1980 SWEET CORN VARIETY EVALUATION

Bob Fournie Farm, Collinsville, Illinois
C. C. Doll

Variety	Source[2]	Days to Harvest[1]	Productive Stalks[3]	Ear Measurements Length	Diameter	Weight	Comments
			(%)	(cm)	(cm)	(g)	
Bellgold	H	65	81.1	18.8	4.1	179	Relatively short plants; fair to good quality; poor fill on side and end.
XP2500	A	66	70.7	20.5	4.2	232	Shucks and leaves burned! snaps easily; long, slender ear, with good flavor and texture.
XP2538	A	66	88.1	17.5	4.3	196	Gold Cup type ear; medium vigor; few suckers; good tip cover.
XP2532	A	66	69.0	19.3	4.1	188	Low vigor and severe drouth injury; variable maturity; double ears; open end; poor fill.
VX709	H	67	78.5	19.0	4.3	202	Medium drouth injury; long ear; poor fill; irregular rows.
Gold Cup	H	68	74.4	18.0	4.0	179	Few second ears; best tip cover in group.
VX719	H	68	59.4	19.3	4.1	207	Good vigor and foliage; suckers and heavy foliage; low yield; good flavor but tough.
Cherokee	A	69	85.7	20.3	4.1	207	Medium vigor; long, tapered ear with good cover; good fill; pulls hard.
Guardian	A	69	73.2	20.3	4.1	188	Good vigor; lots of suckers; long, slender ear with good fill.
VX 749	H	69	50.0	22.5	3.9	202	Low vigor; double ears; open tip; small kernel; fair flavor.
Comanche	A	70	85.0	19.5	4.1	202	Similar to Gold Cup; lots of double ears; poor end fill on a tapered ear.
BVX 849	H	71	77.7	23.8	4.0	202	Slender, weak stalk; long, slender ear with poor pollination.

[1]Planted May 19, 1980; average of 3 replications.
[2]Seed sources are: A = Asgrow; H = Harris
[3]Number of productive stalks in a period of heat, drouth, and pollination stress during maturation.

TABLE 4. PERFORMANCE OF HIGH SUGAR SWEET CORN CULTIVARS, 1980

Dixon Springs Agricultural Center
C. M. Sabota and J. W. Courter

Cultivar	Source[1]	Days[2]	Yield[3]		Plant	Ear Characteristics[5]					
			No.	Mkt.	Stand[4]	Wgt.	Length	Dia.	Husk	Tip	Blank
				(%)		(lbs)	(cm)	(mm)			
Early Xtra Sweet	I	59	6.3	0	7.7	2.1	18	40	7	5	1
SX 1009	H	62	8.0	91	8.7	2.5	20	40	5	8	8
Extra Sweet 77	I	63	6.0	50	7.7	2.5	19	43	2	7	6
Exp. 78-17409	I	63	9.0	78	8.3	2.5	20	42	7	8	8
Wondersweet	H	67	6.6	65	7.3	2.8	21	43	3	8	8
Illini Xtra Sweet	I	69	7.4	64	8.0	2.8	21	44	4	7	7
Sugar Time	SU	72	7.3	83	8.0	2.3	22	40	6	8	8
Honeycomb	SU	72	8.0	66	9.3	2.3	21	41	8	6	8
Pennfresh	AG	73	7.0	86	7.3	2.5	22	41	7	7	8
Sugar Loaf	SU	74	8.0	71	8.7	2.6	19	45	4	5	7
SX 1019	H	74	9.3	86	9.3	2.3	20	41	8	7	8
Sucro	R	74	8.6	85	9.7	2.8	22	44	7	8	8
Fla Sta Sweet	I	76	9.0	78	8.3	2.3	20	40	9	8	7

[1]Source: see listing at end of report.
[2]Planted: 5/27/80, 10 plants per plot. Data are means of three replications.
[3]Yield: average number of ears harvested in once over harvest and percentage marketable ears.
[4]Plant stand: average number of plants per plot.
[5]Characteristics of five husked ears; ratings 0 - 10:

Husk protection: 10 = complete, tight, cover

Tip: 10 = filled completely

Blank: 10 = No missing kernels or blanking on ear.

TABLE 5. PERFORMANCE OF BICOLOR SWEET CORN CULTIVARS, 1980

Dixon Springs Agricultural Center
C. M. Sabota and J. W. Courter

Cultivar	Source[1]	Days[2]	Yield[3] No.	Yield[3] Mkt.	Plant Stand[4]	Ear Characteristics[5] Wgt.	Length	Dia.	Husk	Tip	Blank
				(%)		(lbs)	(cm)	(mm)			
Harmony	H	60	7.0	0	8.3	1.6	16	38	9	7	2
XP 2547	A	61	8.5	6	9.0	2.5	19	40	7	6	1
Peaches & Cream	MU	65	8.7	84	8.0	2.2	21	42	5	9	4
BVX 809	H	67	8.7	0	8.7	2.6	22	44	0	6	7
XP 703	AG	68	9.6	66	9.3	2.1	19	42	9	9	6
Calico	A	68	6.3	38	8.7	2.2	22	41	8	4	4
Sweet Sal	H	69	10.0	90	9.7	2.3	20	42	10	8	8
XP 710	AG	69	7.0	53	8.7	2.7	23	43	2	7	7
Bi Queen	R	70	10.3	93	8.7	2.3	21	40	7	9	7
Calypso	R	70	5.5	55	9.5	2.3	20	43	7	6	4
CRYN 7907	CR	71	4.6	7	7.7	2.3	23	42	4	3	7
Sweet Sue	H	71	7.6	44	8.0	1.9	19	37	10	7	4
BVX 819	H	72	9.0	50	9.5	2.2	21	41	10	8	7
BVX 829	H	72	7.7	26	8.7	2.5	26	37	0	6	5
Symphony	H	73	5.3	100	7.3	1.5	18	40	9	8	9
BVX 849	H	76	6.0	83	8.0	1.9	24	37	9	7	7

[1]Source: see listing at end of report.
[2]Planted: 5/27/80, 10 plants per plot. Data are means of three replications.
[3]Yield: average number of ears harvested in once over harvest and percentage marketable ears.
[4]Plant stand: average number of plants per plot.
[5]Characteristics of five husked ears; ratings 0 - 10:

Husk protection: 10 = complete, tight, cover
Tip: 10 = filled completely
Blank: 10 = No blanking

TABLE 6. BI-COLOR SWEET CORN OBSERVATIONS, 1980

Urbana, Illinois
J. M. Gerber and J. Schmidt

Cultivar[1]	Source	Harvest Date	Marketable Yield	Husked Ears Dia.	Husked Ears Length	Husked Ears Weight	Notes[2]
			(doz/a)	(in)	(in)	(oz)	
Sugar & Gold	S	7/15	725	1.5	6.5	4.8	SE
Ruby Gem	S	7/15	700	1.4	7.0	4.8	SE
Sprite	H	7/16	900	1.6	7.5	6.4	A
Butter & Sugar	S	7/18	1100	1.4	7.0	4.8	SE
Harmony	H	7/19	1025	1.4	7.0	6.4	PF
XP 2577 BC	A	7/19	1050	1.7	8.5	6.4	A
Sweet Sal	H	7/21	1500	1.5	8.0	6.4	A
Calico	A	7/22	725	1.5	8.0	6.4	PF
Bi Lightning	AC	7/23	900	1.6	8.0	8.0	A
Sweet Sue	H	7/24	775	1.5	8.5	6.4	A
Burgundy Delight	S	7/30	1050	1.3	6.5	6.4	A
Seneca Pinto	PS	7/31	825	1.6	7.5	8.0	A

[1]Planted May 9, 1980; spacing 3 x 1 ft. in a block of 4 rows each 25 ft. long; harvested middle 2 rows.
[2]Abbreviations: A = attractive ear, SE = small ear; PF = poor fill

Fall Crop Observations:

A second planting was made on July 9, 1980. Although no harvest data were collected, observations were made. Sweet Sue, Sweet Sal, Seneca Pinto and Burgundy Delight demonstrated potential for late season planting.

TABLE 7. LATE SWEET CORN OBSERVATIONS

Northern Illinois - 1980
J. M. Gerber and W. F. Whiteside

Variety[1]	Source	Seeding: Mid-June[2]	Seeding: Mid-July[3]	Ear Characteristics[2]: Wt.	Ear Characteristics[2]: Length	Ear Characteristics[2]: Width	Notes[4]
		(doz/a)	(doz/a)	(oz)	(in)	(in)	
RXP-214	RS	1080	90	8.3	7.5	1.8	PF
RXP-258	RS	1170	330	10.6	8.0	2.0	A
Golden Queen	R	315	330	4.8	5.0	1.3	PF
74-3045	R	360	390	8.0	7.0	1.9	PF
76-2552	R	450	300	5.9	6.5	1.8	PF, SE
76-2570	R	1125	90	7.2	7.5	1.8	
76-2681	R	720	60	8.3	7.5	1.9	
76-2683	R	1215	0	9.1	8.0	2.0	A
Apache	A	1260	480	8.0	8.0	1.8	
Cherokee	A	945	210	8.0	7.5	1.9	
Capitan	A	1080	720	8.5	8.0	1.9	A
Merit	A	1170	300	9.6	6.5	2.2	A
XP-2548W	A	450	60	8.5	7.5	1.9	
XP-2539	A	0	180	4.0	-	-	SE
Silver Queen	H	360	-	7.0	5.0	1.3	PF
Gold Cup	H	990	-	7.5	7.9	1.9	
Bellringer	H	1215	870	8.8	6.5	1.8	A
Golden Gleam	H	945	660	7.5	7.5	1.7	
Seneca Scout	H	900	270	7.4	6.0	1.7	
H-445	H	1215	570	7.5	6.5	1.8	A
VX-729	H	1035	690	10.4	8.5	1.9	A
VX-719	H	1035	540	10.4	8.5	2.0	A
VX-749	H	1125	420	9.1	8.5	1.9	A
VX-739	H	1170	-	10.1	9.0	2.0	A
VX-709	H	945	240	9.6	8.5	2.0	A

[1]Grown with standard grower practices. Frequent rains prevented effective control of root worm beetles during pollination.
[2]Kane County. Seeded June 19, 1980; harvested September 9, 1980.
[3]Will County. Seeded July 15, 1980; harvested October 2, 1980.
[4]Abbreviations: A = attractive ear, SE = small ear, PF = poor fill.

TABLE 8. MUSKMELON VARIETY TRIAL, 1980

Kilbourne Sand Field
L. R. Nelms

Variety Name[1]	Source	Total Yield[2]	Marketable Yield[2]			Notes
			Number	Bushels	Size	
		(no/a)	(no/a)	(bu/a)	(lbs)	
Gold Star	H	8715	7470	1004	6.7	Looks good, heavy, elevated net.
Star Trek	H	8839	7885	943	6.0	Very nice, heavy, elevated net.
Supermarket	H	9005	8300	886	5.4	Nice, medium coarse net.
Dixie Jumbo	PS	8424	009	882	5.5	Firm, shipping type. Picks heavily over short time interval.
Burpee Hybrid	BUR	7055	5810	814	7.0	Nice; prolonged harvest.
Classic Hybrid	PS	6017	6017	799	6.6	Looks good, medium-heavy net. Picked but in short time.
XPH 771	A	8715	6764	746	5.5	Light-medium netting.
Iroquois	H	6100	4689	725	7.8	Many fruit too large for market. Prolonged harvest.
Star Headliner	AC	7470	5395	717	6.7	Looks good, medium heavy net.
Ball 1776	BA	7470	5934	709	5.9	Very nice, heavy, elevated net. Picked out heavily in a 3 day period.
Carnival	A	7179	6100	674	5.6	Light-medium net. Several light harvest.
Summet	A	7179	6100	674	5.4	Nice, medium coarse net. Prolonged harvest.
Ambrosia	BUR	7470	5810	627	5.4	Light net, uniform rind.
Saticoy	H	3527	3112	506	8.1	Looks good, very light netting.
Hales Best	PS	6889	4565	411	4.5	Very firm, shipping type. Picked out fast.
Hybrid Early Sweet	EM	9130	4150	258	3.1	Early, but small. A few heavy pickings.
Delicious 51	H	7470	1784	166	4.6	Poor, much radial cracking around stem scar. Often difficult to separate from vine
Harvest Queen	A	1660	1369	154	5.6	Looks good, but late.

[1]Direct seeded into plastic mulch on May 14, 1980. Reseeded due to poor germination on June 3, 1980. Thinned to one plant every 2 ft. in 15 ft. rows which were 7 ft. apart. There were 7 plants per plot and 3 replications.

[2]Harvested from July 23 - August 28.

TABLE 9. WATERMELON VARIETY TRIAL, 1980

Kilbourne Sand Field
L. R. Nelms

Variety Name[1]	Source	Yield[2] Fruit/A		Melon Size
		(no/a)	(tons/a)	(lb)
Charleston Gray	H	4261	50.8	23.8
Garrisonian	K	2488	33.1	26.6
Jubilee W.R.	NK	1960	26.3	26.8
Allsweet	H	2177	25.5	23.5
Crimson Sweet	H	1960	20.8	21.2
Iopride	IA	1960	19.2	18.8

[1]Direct seeded in plastic mulch on June 3, 1980. Thinned to one plant every 2-1/2 ft. in 20 ft. rows which were 7 ft. apart. There were 6 plants per plot and 3 replicates.

[2]Harvested from August 20 - September 3.

TABLE 10. BELL PEPPER VARIETY TRIAL, 1980

Kilbourne Sand Field
J. M. Gerber, L. R. Nelms and J. C. Schmidt

Variety Name[1]	Source	Fruit/Plant	Fruit Size	Culls	Notes[3]
		(no)	(oz)	(%)	
Yolo Wonder B	PS	9.7 (2.1)[2]	3.5	20	PB
Hybelle	H	9.3 (3.3)	3.2	12	B
Midway	SS	9.0 (1.9)	3.1	9	B
Super Set	SS	8.8 (6.6)	2.8	12	P
Lady Belle	H	8.8 (5.2)	2.5	9	B
California Wonder	PS	8.5 (2.8)	3.3	10	B
Emerald Giant	H	8.5 (4.2)	3.6	10	PB
Tasty Hybrid	BUR	8.4 (4.7)	2.5	35	PB
Ace Hybrid	SS	8.4 (7.3)	2.4	6	P
Early Hybrid	SS	8.0 (5.0)	2.6	21	P
Early Cal Wonder	PS	8.0 (2.7)	2.8	25	PB
Merrimack Wonder	BUR	7.6 (3.8)	2.3	9	PB
Pip	A	7.2 (1.7)	3.0	25	B
Early Niagra Giant	SS	7.1 (2.9)	3.3	15	B
New Ace Hybrid	BUR	6.9 (7.1)	2.8	9	P
Keystone Res. Giant	H	6.7 (2.6)	3.4	12	PB
Yolo Wonder L	A	6.6 (2.6)	3.1	23	PB
Fordhook	BUR	6.1 (6.5)	2.6	6	B
Staddons Select	H	4.8 (3.1)	3.2	13	B
Lincoln Bell	SS	4.4 (3.2)	3.0	25	PB

[1]Seeded on April 1 and transplanted to the field on May 21; spacing 5 x 2.5 ft. in two 15 ft. rows (3500 plants/acre).
[2]The numbers in parentheses represent the average number of fruit per plant in the trial at Urbana. These plants were grown under extreme heat stress without irrigation in 1980. This should provide an indication of the potential of these varieties when grown under sub-optimum conditions.
[3]P = mostly pointed, B = mostly blocky, PB = mixed or non-uniform

TABLE 11. TOMATO VARIETY OBSERVATIONS, 1980

Urbana, Illinois
J. M. Gerber and J. C. Schmidt

Variety[1]	Source	Total Marketable Yields	Culls	Fruit Size	Notes[2]
		(lbs/plant)	(%)	(oz)	
Early Girl	BA	10.0	23	3.0	I
Show Me	UM	9.7	9	6.5	I, GC
Duke	PS	8.7	9	6.1	SD
Red Glow	AC	8.5	26	4.9	I
Floramerica	H	7.9	11	6.0	I
Market Hyb. #45	FM	7.6	13	7.5	SD, PC
Sir Walt	AC	7.3	38	5.8	SD
Market Hyb. #46	FM	7.2	23	6.8	SD
Springset	H	6.4	41	4.3	D, PC
Sunripe	BA	6.2	41	5.7	SD, GC
Campbell 1327	H	6.2	27	6.6	SD, GC
Count	PS	6.1	25	5.5	SD, GC
Mocross Suprise	BA	5.9	36	4.8	I
Market Hyb. #39	FM	5.5	36	7.0	SD
Baron	PS	5.4	17	5.6	D, PC
Jet Star	H	5.3	38	5.7	I, GC
Supersonic	H	5.2	35	6.8	I, GC
Glamour	H	5.0	25	4.3	I
Market Hyb. #52	PS	4.9	25	6.6	SD
Heinz 1350	H	4.6	29	5.0	I, GC
Fireball	H	4.0	20	3.8	D
Heinz 1370	AC	4.0	14	4.1	I
Mainpak	H	3.9	19	7.8	I, GC
Castle 105	C	3.8	37	7.3	I, GC
Fullhouse	FM	3.7	46	6.6	SD
Better Boy	BUR	3.5	44	6.6	I, GC
Mocross Supreme	BA	3.3	22	4.2	I, GC
MH-1	PS	2.4	31	5.0	I, GC
Big Boy	BUR	1.4	48	6.2	I, GC
Big Girl	BUR	0.8	65	8.8	I, GC
Supersteak	BA	0.8	50	13.0	I, GC
Beefsteak	BUR	0.5	63	8.0	I, GC
Rutgers	BUR	0	100	--	I, GC

[1]Seeded on April 1 and transplanted to the field on May 23; spaced 3 x 3 ft. in two 20 ft. rows.
[2]Abbreviations: I = indeterminate, SD = semi-determinate, D = determinate, GC = good foliage cover, PC = poor foliage cover

TABLE 12. TOMATO VARIETY OBSERVATIONS, 1980

Kilbourne Sand Field
J. M. Gerber and L. R. Nelms

Variety[1]	Source	Early Yield[2] (lbs/plant)	Total Yield[2] (lbs/plant)	Culls (%)	Fruit Size (oz)	Notes[3]
Mocross Supreme	BA	2.7	5.5	38	6.4	I
Duke	PS	1.7	5.4	45	7.2	SD
Jet Star	H	2.3	5.1	36	6.7	I
Early Girl	BA	3.0	4.8	63	4.5	I
Pik Red	H	2.5	4.5	33	7.5	SD
Fullhouse	FM	2.3	4.5	52	9.1	SD
Castle 105	C	2.3	4.3	46	7.1	I
Glamour	H	2.3	4.1	44	6.5	I
Market Hyb. #52	FM	1.1	3.9	40	7.0	SD
Count	PS	2.0	3.7	44	5.8	SD
Mocross Suprise	BA	2.9	3.6	55	6.7	I
Fireball	H	3.0	3.6	20	3.3	D
Big Girl	BUR	1.9	3.5	30	7.7	I
Springset	H	3.1	3.5	46	4.0	D
Baron	PS	2.8	3.5	39	6.5	SD
Heinz 1350	H	1.2	3.5	31	4.5	I
Better Boy	BUR	2.1	3.4	59	9.2	I
Show Me	UM	1.5	3.4	50	6.4	I
Heinz 1370	AC	1.6	3.2	56	6.1	I
Sunripe	BA	1.9	3.0	65	7.7	SD
Sir Walt	AC	2.0	2.9	43	5.4	SD
Market Hyb. #45	FM	1.2	2.9	59	9.5	SD
Red Glow	AC	2.2	2.8	57	7.0	I
Mainpak	H	1.3	2.4	46	7.7	I
Supersonic	H	1.1	2.4	54	6.3	I
MH-1	PS	1.9	2.3	36	4.4	I
Floramerica	H	0.6	2.0	77	8.6	I
Supersteak	BA	0.9	1.9	57	11.1	I
Rutgers	BUR	0.9	1.8	46	7.0	I
Market Hyb. #46	FM	1.3	1.8	67	8.7	SD
Market Hyb. #39	FM	1.3	1.4	80	9.0	SD
Big Boy	BUR	0.6	1.6	51	5.5	I
Beefsteak	BUR	0.3	0.8	78	11.2	I

[1]Seeded on April 1 and transplanted on May 19; spacing 5 x 2 ft. in a 20 ft. row (4350 plants/acre).
[2]Early yield: 7/14 - 8/5; total yield: 7/14 - 8/19
[3]Abbreviations: I = indeterminate, SD = semi-determinate, D = determinate

TABLE 13. 1980 TOMATO OBSERVATION TRIAL

Dixon Springs Agricultural Center
C. M. Sabota and J. W. Courter

Variety	Source	Market Yield (lbs/pl)	Percent Early (to 7/17)	Fruit Size (oz)	Culls (%)
Count	PS	11.7	7	4.7	24
Market Hyb. #46	FM	11.1	6	6.9	27
Duke	PS	10.3	10	5.5	17
Market Hyb. #39	FM	9.9	5	6.5	20
Pik Red	H	9.8	16	6.6	21
Roadside Red	AG	9.4	16	4.5	15
Jet Star	H	9.1	16	5.1	25
Pink Panther	BA	8.9	3	5.8	11
Jumbo	H	8.6	0	6.3	27
Royal Flush	FM	8.2	9	5.7	25
Freedom	T	8.1	6	5.1	27
Rutgers	BUR	8.0	5	5.9	28
Jackpot	FM	7.6	11	6.2	37
Baron	PS	7.6	25	5.1	23
Show Me	UM	7.4	22	5.7	42
Main Pak	H	7.3	2	7.1	31
PS 4	UI	7.0	57	3.6	36
Market Hyb. #52	FM	6.9	8	4.7	27
PS 4-0	UI	6.6	44	3.5	34
Castlehy 105	C	6.0	3	6.1	24
Blazer	FC	5.9	16	5.7	54
Longkeeper	BUR	5.7	1	4.0	12
Fullhouse	FM	5.3	23	4.9	28

Planted: May 12, 1980
Harvest: Early - 7/9 to 7/17, Season 7/9 to 8/18

TABLE 14. UNION COUNTY FRESH MARKET TOMATO TRIAL, 1980

Cerney Farm, Cobden
William Wagner and J. W. Courter

Cultivar	Source	Early Harvest (7/7 to 7/18)	Total Marketable Harvest (7/7 to 8/3) Yield/Plant	U.S. No. 1	Fruit Size	Culls	Notes[1]
		(% of total harvest)	(lbs)	(%)	(oz)	(%)	
Jet Star	Harris	30	10.4	61	7.6	13	I, good foliage cover
Count	Peto	37	10.3	68	5.6	11	D, good cover, some early blight, green shoulder
Castle 105	Castle	20	10.0	72	7.5	12	I, excellent cover
OC6F	Harris	68	8.7	64	6.9	9	I, good cover, cracks
Show Me	UM	45	8.5	41	8.2	5	I, good cover
MH #45	FM	59	8.2	74	9.8	16	D, fair cover
MH #46	FM	35	8.2	70	8.3	18	D, fair cover, some early bligh
MH #39	FM	58	8.1	65	8.2	18	D, fair cover, uniform ripening, pointed blossom end
Royal Flush	FM	58	7.7	59	8.5	15	D, good cover
Duke	Peto	53	7.4	54	7.0	6	D, fair cover
Jackpot	FM	48	6.8	50	6.6	24	D, fair cover, leaf roll, some early blight
Pik Red	Harris	69	5.4	73	7.5	27	D, poor cover

Seeded: 4/1/80 in Jiffy 7 pellets
Planted: 5/6/80, 6 plant plots, non-irrigated upland, plants staked.
[1]I = indeterminate, D = determinate.

TABLE 15. PROCESSING TOMATO OBSERVATIONS, 1980

Kilbourne Sand Field
J. M. Gerber and L. R. Nelms

Variety[1]	Harvest[2] Date	Yield Red	Yield Green	Yield Culls	Yield Total	Green (Numbers)	Culls (Numbers)	Fruit Size	Source[3]
		(tons per acre)				(%)	(%)	(oz)	
Ohio 7814	7/20	10.1	9.0	1.2	20.3	55	8	1.8	Berry
ST 48	7/24	11.0	5.3	1.7	17.0	43	5	3.2	Metcalf
H 727	7/24	14.6	5.4	1.4	21.4	53	2	2.6	Ematty
H 2653	7/24	16.0	15.9	0.3	32.2	58	1	2.3	Ematty
TH 318	7/24	14.8	3.8	0.9	19.5	33	5	3.6	Ematty
PS-4	7/24	16.9	6.0	--	22.9	46	-	3.6	George
PS4-0	7/24	16.4	6.0	--	22.4	50	-	4.1	George
Ont. 7616B	7/24	12.6	10.7	0.3	23.6	59	1	2.0	Kerr
H 727	7/24	15.5	10.0	0.5	26.0	39	6	2.8	Ematty
ST 52	7/28	9.6	13.0	2.2	24.8	68	8	3.3	Metcalf
PU 80A41	7/28	9.2	14.4	0.8	24.4	52	3	2.1	Tigchelaar
Peto 80	7/28	19.0	15.4	1.4	35.8	48	5	1.7	Ematty
Md 149	7/28	22.0	9.1	1.3	32.4	37	4	2.1	Bouwkamp
Md 153	7/28	19.0	10.2	1.1	30.3	43	4	2.3	Bouwkamp
Ohio 7955	7/28	16.6	9.4	1.1	28.1	34	4	2.2	Berry
TH 318	7/28	20.2	4.6	2.2	27.0	29	7	3.5	Ematty
Md 151	7/28	10.6	12.7	1.5	23.8	57	7	1.8	Bouwkamp
PU 80A26	7/28	16.7	11.5	1.0	29.3	49	3	2.6	Tigchelaar
Md 154	7/28	12.8	11.7	1.6	26.1	60	6	1.9	Bouwkamp
79B6	7/28	10.5	13.0	1.7	25.2	54	7	2.2	Stoner
PU 80A04	7/30	21.5	7.1	1.5	30.1	36	4	2.3	Tigchelaar
Ont. 781	7/30	18.1	5.8	2.1	26.0	36	7	3.5	Kerr
Ohio 7868	7/30	16.3	8.2	2.5	27.0	43	9	2.5	Berry
Hunts 208	7/30	15.8	20.0	3.0	38.8	61	7	4.3	Ematty
Ont. 771	7/30	18.4	9.0	2.1	29.5	45	5	4.5	Kerr
Chico III	7/30	23.1	17.1	1.3	41.5	53	3	2.1	Ematty
H 722	8/1	16.1	12.1	2.2	30.4	51	8	2.3	Ematty
80 NC 109	8/1	19.6	11.6	1.7	32.9	48	5	2.2	Henderson
Ohio 7870	8/6	11.3	5.8	2.0	19.1	37	9	2.7	Berry
H 722	8/6	23.7	6.9	1.3	31.9	28	5	2.1	Ematty

(continued)

Variety[1]	Harvest[2] Date	Yield Red	Green	Culls	Total	Green (Numbers)	Culls (Numbers)	Fruit Size	Source[3]
		(tons per acre)				(%)	(%)	(oz)	
Md 155	8/6	22.1	9.1	2.8	32.0	36	9	2.3	Bouwkar
79B35	8/6	14.9	9.8	4.1	28.8	44	16	2.6	Stoner
79B9	8/7	9.6	13.9	3.4	26.9	59	15	3.0	Stoner
Ont. 7920	8/7	14.7	11.3	5.8	31.8	46	15	3.9	Kerr
80 NC 107	8/7	20.7	11.5	4.5	36.7	50	9	2.2	Henders
ST 51	8/7	20.0	9.8	3.2	33.0	45	10	1.9	Metcali
80 NC 108	8/7	21.4	6.5	3.2	31.1	26	10	2.4	Henders
C-28	8/7	27.6	4.8	3.6	36.0	19	10	4.0	Ematty
Ont. 7924	8/12	15.5	6.9	9.0	31.4	38	26	2.8	Kerr
Ohio 7864	8/12	11.8	6.4	8.2	26.4	31	31	2.8	Berry
79 B 38	8/12	17.0	4.4	8.7	30.1	22	28	3.5	Stoner
Ont. 777E	8/12	16.9	9.0	6.4	32.3	38	18	3.9	Kerr
VF 134	8/12	18.1	2.9	7.3	28.3	13	29	2.7	Ematty
C-37	8/12	25.1	3.6	10.5	39.2	14	29	3.2	Ematty

[1]Seeded on April 1 and transplanted on May 14; spacing 5 x 1 ft. in a 20 ft. row.
[2]Once-over harvest of all fruit.
[3]Scientists cooperating in Northern Tomato Evaluation Program.

SOURCES OF VEGETABLE VARIETIES

We gratefully acknowledge the following companies and universities for seed used in our trials. Inclusion or exclusion of companies in this list does not constitute a recommendation. Not all of these companies sell seeds directly to commercial growers.

A	Leo J. Zanoni, Asgrow Seed Co., Kalamazoo, MI 49001
AC	Abbott & Cobb, Box 307, Feasterville, PA 19047
AG	Agway, Inc., Box 1333, Syracuse, NY 13201
BA	Jan P. Umstead, Ball Seed Co., Box 335, West Chicago, IL 60185
BUR	W. Atlee Burpee Co., 615 N. 2nd St., Clinton, IA 52732
C	Dr. F. F. Angell, A. L. Castle, Inc., Box 877, Morgan Hill, CA 95037
CR	Crookham Company, Box 520, Caldwell, ID 83605
DM	Del Monte Corporation, P.O. Box 89, Rochelle, IL 61068
FM	Robert Baermann, Ferry-Morse Seed Co., Box 100, Mountain View, CA 94040
FC	F.M.C. Corp., A.C.D., Western Res. Ctr., P.O. Box 2508, El Macero, CA 95618
H	Wilbur Scott, Joseph Harris Co., Inc., Moreton Farms, Rochester, NY 14624
I	Floyd Ingersoll, Illinois Foundation Seeds, R-1, Tolono, IL 61880
IA	Iowa State University, Muscatine Island Field Sta., Fruitland, IA 52749
K	Keystone Seeds, P.O. Box 1438, Hollister, CA 95023
MU	Walter Whitwood, Musser Seed Co., Inc., 1403 Chicago, P.O. Box 787, Caldwell, ID 83605
NK	Iver Jorgenson, Northrup King & Co., 1500 Jackson Street, NE, Minneapolis, MN 55413
PS	Paul Thomas, Petoseed Company, Inc., Box 4206, Saticoy, CA 93003
R	John Brewer, Rogers Bros. Seed Co., Box 1647, Idaho Falls, ID 83401
RS	Robson Seed Farms Corporation, 1 Seneca Circle, Hall, NY 14463
S	George Oswald, Seedway, Inc., Hall, NY 14463
SS	Stokes Seeds, Inc., Box 548, Buffalo, NY 14240
SU	Sun Seeds, Inc., 9301 Bryant Ave. S., Bloomington, MN 55420
T	Otis S. Twilley, Box 65, Trevose, PA 19047
UI	Dr. W. L. George, Department of Horticulture, University of Illinois, Urbana, IL 61801
UM	Dr. Victor Lambeth, University of Missouri, Columbia, MO 65201

VEGETABLE VARIETIES FOR COMMERCIAL GROWERS

J. W. Courter and J. M. Gerber

To obtain optimum yield and quality, it is important for commercial market growers to select vegetable varieties that are adapted to local conditions. This circular provides an up-to-date listing of varieties suitable for Illinois. Not all varieties will be appropriate for all the diverse growing and marketing conditions found in Illinois. In selecting varieties for your operation, you should take into account the preference of your particular market, the time at which the variety can be expected to mature, your methods of culture, and the adaptability of the varieties to your soil and climate. As a further aid, you might consult current catalogs and trade publications for other promising varieties. No one seed company can provide all the best varieties for each individual operation. Therefore, growers may have to check several sources in order to find recommended varieties. For a list of seed companies and distributors, check Horticultural Facts VC-10-80, titled "Sources of Vegetable Seeds". Single copies may be obtained from your county Extension office or from the Department of Horticulture, 124 Mumford Hall, University of Illinois, Urbana, IL 61801.

Many of the vegetable varieties that show promise for Illinois have only recently been introduced. These are being compared to the standard varieties in field tests before being included in the list of recommendations. The latest results of vegetable trials can be found in the proceedings of the Illinois Vegetable Growers Schools. Copies may be obtained for $3 either from your county Extension office or from the Department of Horticulture, 124 Mumford Hall, University of Illinois, Urbana, IL 61801.

Additional information on varieties of these and other vegetables may be found in Circular 1150, Vegetable Gardening for Illinois. Copies are available for $2 from the Office of Publications, 123 Mumford Hall, University of Illinois, Urbana, IL 61801. When ordering either publication, make checks payable to the University of Illinois.

Growers often find hybrids (noted with an asterik*) to be superior to older varieties because they combine desirable characteristics, such as uniformity of plant and fruit type, uniform maturity, disease resistance, quality and vigor. A hybrid, by definition, results from cross breeding two parental lines (or varieties) differing in at least one (but usually more) important characteristic. Varieties are pure lines that breed true from seeds. The resulting hybrid vigor is evidenced by improved growth and yield. Hybrid seed is usually more expensive than seed from an open-pollinated variety but merely because it is labeled "hybrid" does not necessarily make it superior to established varieties. Resistance to disease, insects, and other factors influencing yield should be considered when planting any new variety.

J. W. Courter and J. M. Gerber are Extension Specialists in Vegetable Crops, University of Illinois.

Growers are encouraged to test new varieties and hybrids to judge the potential for their area, use, or market. Some factors that influence performance of a variety or hybrid include climate - temperatures, rainfall, humidity; soil - type, fertility, drainage; season - spring, summer, or fall cropping; culture - planting distances, training methods, mulch, fertilizer treatment; method of harvest; and intended use - fresh, storage, processing, or marketing. These factors will vary in their influence for different locations in the state.

The following tips will help growers to conduct their own trials to evaluate new varieties and hybrids.

1. Limit the number of new ones to try.

2. Compare them with your standard or favorite.

3. Select a location with uniform soil and drainage where all will receive the same spray and cultural treatments. Avoid the edge of a field where uncontrollable factors may influence the results.

4. Plant all the varieties on the same day and in the same way, both in the greenhouse and in the field. Be careful not to mix seeds or plants.

5. Label each row or plant carefully. Draw a map and keep it in a safe place.

6. Record observations of plant growth, yield, disease, and fruit characteristics. These records will help to make variety decisions next year.

ASPARAGUS

Beacon*
Mary Washington
Waltham Washington

BEAN, LIMA

Allgreen
Fordhook 242
Henderson Bush
Thaxter
Thorogreen

BEAN, SNAP

(green)

Astro
Avalanche
Blue Crop
Bush Blue Lake
Cascade
Contender
Del Ray
Eagle (trial)
Early Gallatin
Galagreen
Green Genes
Greensleeves
Harvester
Provider
Slenderette
Spartan Arrow
Sprite Tendercrop
Tenderette
Tendergreen

BEAN, SNAP

(yellow)

Gold Crop
Midas

BEAN, SNAP

(yellow continued)

Moongold
Resistant Cherokee
Resistant Kinghorn
Sungold

BEETS

Crosby Green Top
Detroit Dark Red
Gladiator
Ruby Queen

BROCCOLI

Green Comet*
Green Duke*
Premium Crop*
Waltham 29

BRUSSELS SPROUTS

Green Gem*
Jade Cross E*

CABBAGE

(fresh market-head)

Danish Ballhead*
Market Prize*
Market Topper*
Market Victor*
Red Danish*
Red Head*
Resistant Danish*
Ruby Ball*
Stonehead*

(fresh market-savoy)

Chieftan Savoy
Savoy Ace*
Savoy King*

(processing)

King Cole*
Roundup*
Titanic*

CARROT

(fresh market)

Dominator*
Gold Pak
Grenadier*
Hi-Pak*
Spartan Fancy*
Trophy*

(processing)

Danvers 126
Red Cored Chantenay
Scarlet Nantes
Spartan Bonus*

CAULIFLOWER

Self-Blanche
Snow Crown*
Snow King*
Snowball Y

CHARD

(red)

Burgundy

(white)

Lucullus

COLLARD

Carolina (trial)
Georgia
Vates

CUCUMBER

(slicing)

Challenger*
Gemini*
Marketmore 76
Marketmore 80
Pacer*
Poinsett
Poinsett 76
Saticoy*
Sweet Slice
Victory*

CUCUMBER

(pickling)

Bounty*
Calypso*
Early Pik*
Premier*
WIS SMR 18

(greenhouse)

Gourmet*
LaReine*

EGGPLANT

(large oval)

Black Magic*
Classic*
Dusky*

(specialty)

Ichiban*
Viserba

LETTUCE

(greenhouse)

Bibb
Grand Rapids

(leaf)

Black Seeded Simpson
Buttercrunch
Grand Rapids
Summer Bibb

KALE

Dwarf Blue Curled Scotch
Dwarf Curled
Dwarf Siberian

LEEK

Conqueror
Electra
Tivi

MUSKMELON

Burpee Crenshaw*
Burpee Hybrid*
Harper*
Harvest Queen
Gold Star*
Saticoy*
Supermarket*

MUSTARD

Green Wave
Southern Giant Curled

OKRA

Clemson Spineless
Dwarf Green Long Pod
Emerald

ONIONS

(yellow)

Abundance*
Downing Yellow Globe
Early Yellow Globe
Fiesta*
Pronto S*
Rocket*
Spartan Banner*
Yellow Sweet Spanish

(red)

Ruby
Southport Red Globe

(white)

Southport White Globe 110
White Sweet Spanish 120

PEPPER

(bell type)

Bell Boy*
California Wonder
Emerald Giant
Hybelle*
Keystone Resistant Giant
Lady Bell*

PEPPER

(bell type continued)

New Ace*
PIP
Staddon's Select
Tasty*
Yolo Wonder

(specialty)

Cubanelle
Hot Portugal
Hungarian Wax
Jalapeno
Red Cherry
Red Chili
Sweet Banana

POTATOES

Katahdin
Kennebec
Norchip
Norland
Pontiac
Superior

PUMPKIN

(small, 4-6 lbs.)

Small Sugar
Spookie
Sugar Pie (Early Sweet Sugar)

(intermediate, 8-15 lbs.)

Spirit*
Youngs' Beauty

(large, 15-25 lbs.)

Connecticut Field (Big Tom)
Howden Field
Jackpot*

SPINACH

(fresh market)

Long Standing Bloomsdale
Melody*
Virginia Savoy
Winter Bloomsdale

SQUASH

(summer)

Early Prolific Straightneck
Golden Girl*
Seneca Butterbar*
Seneca Prolific*
Zucchini Elite*
Zucchini Hybrid*

(winter)

Acorn
- Table Ace
- Table King
- Table Queen

Butternut
- Big Max
- Buttercup
- Delicious, Golden
- Hercules
- Hubbard
- Hybrid Butternut*
- Kinred
- NK 530*
- NK 580*
- Turk's Turban
- Vegetable Spaghetti
- Waltham Butternut

SWEET CORN

(early)

Aztec
Earlibelle
Earliking
Northern Belle
Spring Gold
Sundance

(main crop)

Bellringer (trial)
Bonanza (trial)
Cherokee (trial)
Gold Cup
Golden Gleam (trial)
Merit (trial)
NK 199
Reliance (trial)
Seneca Chief
Seneca Scout (trial)
Style Pak
Sweet Sal (bicolor)
Sweet Sue (bicolor)

SWEET CORN

(late)

Biqueen (bicolor)
Country Gentlemen
Golden Queen
Silver Queen

(high sugar)

Candy Bar (trial)
Candyman (trial)
Early Xtra Sweet (trial)
Honeycomb (trial)
Illini Xtra Sweet (trial)
Penn Fresh (trial)
Sugar Loaf (trial)

SWEET POTATO

Centennial
Jewel
Nugget

TOMATO

(early)

Campbell 1327
Early Girl (north)
Heinz 1350
Heinz 1439
Spring Giant
Springset (north)
Starfire (north)

(main crop and late)

Better Boy
Better Girl (trial)
Big Girl (trial)
Bragger (trial)
Burpee VF
Floramerica (trial)
Jet Star
Main Pak
Pink Wrap (pink)
Pik Red
Royal Flush (trial)
Show-Me (trial)
Sunripe
Super Fantastic
Supersonic
Traveler 76 (pink)
Wonder Boy VF

(yellow, orange)

Golden Boy
Jubilee
Sunray

(greenhouse)

Michigan-Ohio Hybrid
Ohio WR-13
Ohio WR-25

TURNIP

Just Right
Purple Top White Globe

WATERMELON

Allsweet
Charleston Gray
Crimson Sweet
Iopride
Jubilee
Seedless Hybrid 313*
Triple Sweet Hybrid*
Yellow Baby*

Fertilizer Guide 198

for Commercial Vegetable Grower

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN • COLLEGE OF AGRICULTURE • COOPERATIVE EXTENSION SERVI
CIRCULAR 11

Commercial vegetable producers depend on chemical fertilizers to supply the nutrients required by their crops. Although many Illinois soils are naturally high in fertility, it is doubtful whether intensive cropping of vegetables could be achieved without adding fertilizer. In fact, many growers have fertilized excessively, resulting in large residual amounts of phosphorus, potassium, calcium, and magnesium in the soil. Although this residual fertility may not be detrimental, applying unneeded fertilizer raises costs without increasing production, thus reducing profits.

As production costs climb, growers find that they are operating with reduced profit margins. Only efficient producers can survive in today's economy. By testing your soil and applying only as much fertilizer as is needed you can save a significant amount of money. Using fertilizer efficiently provides greater profit and minimizes the release of potential pollutants into the environment.

Testing Your Soil

To determine how much of each nutrient must be added for optimum crop production, collect soil samples every 2 or 3 years and have them analyzed for pH and for phosphorus and potassium concentrations. The test results and your knowledge of the field's cropping and fertilization history will provide the information you need to develop a fertilization plan for the crop to be grown.

Samples should be collected in the late fall when the soil is relatively dry but not yet frozen. Separate samples should be tested for every field that differs in color, slope, drainage, or previous fertilization and cropping. Each sample should represent no more than 4 acres and should consist of several subsamples collected at random locations throughout the field. Check with your soil testing laboratory for more specific instructions.

Determining Fertilizer Application Rates

The soil test results will be reported in terms of the amount of elemental phosphorus (P) and elemental potassium (K) per acre. Referring to Table 1, determine wh of the four soil fertility groups (A through D) your so phosphorus test level fits into. Then do the same for t potassium test level. These groups can then be used in co junction with Table 2 to determine how much of the t nutrients you should add for the crop you plan to grow.

Locate the crop in Table 2, and then find the colur under the phosphorus heading that corresponds to yo soil's fertility group for phosphorus. The numbers in t column below the fertility group will tell you how ma pounds of P_2O_5 you need to apply per acre to increase t phosphorus content to a satisfactory level. Follow the sar procedure using the numbers in the potassium column determine how much K_2O you should apply. If soil te results are not available, use the amounts of phosphor and potassium recommended for fertility group B.

Since soil tests for nitrogen are of little value, the nitr gen recommendations in Table 2 are based on the needs the various crops, but in developing a fertilization progra you should also take into account the field's cropping histo and the type of soil.

If the crop grown in the field during the previous ye was a legume (soybeans or alfalfa), the amount of nitroge applied can be 25 to 30 pounds per acre less than th recommended in Table 2. The nitrogen status of mo vegetable crops can be determined by the color of th foliage. A pale green or slightly yellow color may indicat a need to apply additional nitrogen.

Unless otherwise indicated, the fertilizer recommenda tions given in this circular are for the mineral soils that pre dominate in Illinois. Vegetable crops grown on sandy soil usually require greater amounts of nitrogen and potassiur Splitting the nitrogen fertilizer between two separate appli cations will result in greater efficiency and production o sandy soils that are irrigated or that receive heavy rainfall

Plantings made early in the season in cool, wet soils ma respond well to the application of band-placed phosphoru

Table 1. Soil Fertility Groups for Phosphorus and Potassium

Nutrient	Fertility group			
	A	B	C	D
		pounds per acre		
Bray P_1 phosphorus (P)	0-25	26-50	51-75	Above 75
Potassium (K)	0-100	101-250	251-350	Above 350

starter solution in addition to the nutrients recom-
led in Table 2.

Vhen more than one crop is to be grown in a field it is ssary to adjust the fertilizer application rates so that the ents needed by all of the crops are supplied. Tailoring tilizer program for such situations is difficult because amount of a nutrient that is considered adequate for one crop may be undesirably low for another. For assistance, consult *Horticulture Facts* No. VC-7-80, "Fertilizer Guide for Market Gardeners," available from your county Cooperative Extension Service adviser or from the Department of Horticulture, 124 Mumford Hall, University of Illinois. Urbana, Illinois 61801.

TABLE 2. FERTILIZER RECOMMENDATIONS FOR VEGETABLE CROPS

	Recommended application rate based on soil tests										
		Phosphorus (P_2O_5)				Potassium (K_2O)				
		Fertility group				Fertility group				
	Nitrogen (N)	A	B	C	D	A	B	C	D	Suggested application method
ARAGUS				*pounds per acre*						
rsery beds	50	200	100	50	25	200	100	50	25	Broadcast and disk
w plantings	0	150	50	25	0	150	50	25	0	Broadcast and plow down
	50	50	50	25	25	50	50	25	25	Side-dress at first cultivation
Total	50	200	100	50	25	200	100	50	25	
tting beds										
Nonhybrids	50	150	100	50	25	200	150	100	50	Broadcast and disk
Hybrids	75	200	150	100	50	300	225	150	75	Broadcast and disk
ndy soils an additional 50 pounds of nitrogen per acre can be applied as a sidedress after cutting. In new beds build up organic er with cover crops and manure 1 or 2 years before planting crowns.										
NS										
na	20	150	100	50	0	150	100	50	0	Broadcast and plow down
	40	40	40	20	20	40	40	20	20	Band 2 in. × 2 in. at seeding
Total	60	190	140	70	20	190	140	70	20	
ap	0	150	100	50	0	100	50	25	0	Broadcast and plow down
	40	40	40	20	20	40	40	20	20	Band 2 in. × 2 in. at seeding
Total	40	190	140	70	20	140	90	45	20	
ap, second crop	30	20	20	20	20	40	40	20	20	Band 2 in. × 2 in. at seeding
ndy soils an additional 25 pounds of nitrogen per acre can be applied as a sidedress when two or three true leaves have appeared. soil pH is greater than 6.7, apply 5 pounds of zinc and 3 pounds of manganese per acre at planting.										
TS	75	150	100	50	25	200	150	100	50	Broadcast and disk
	50	0	0	0	0	0	0	0	0	Side-dress 4 to 6 weeks after planting
Total	125	150	100	50	25	200	150	100	50	
y 3 pounds of boron per acre on clay loams and 1 pound per acre on sandy soils.										
CCOLI AND LIFLOWER	100	200	150	75	50	200	150	75	50	Broadcast and disk
	50	0	0	0	0	0	0	0	0	Side-dress 2 to 3 weeks after transplanting
	50	0	0	0	0	0	0	0	0	Side-dress 5 to 6 weeks after transplanting if required
Total	200	200	150	75	50	200	150	75	50	
y 2 pounds of boron per acre on clay loams and 1 pound per acre on sandy soils if the pH is greater than 6.7. Early plantings in soil may respond well to a high-phosphorus starter solution.										
BAGE, COLLARDS, KALE	75	150	100	50	25	150	100	50	25	Broadcast and disk
	50	0	0	0	0	0	0	0	0	Side-dress 4 weeks after planting
Total	125	150	100	50	25	150	100	50	25	
plantings in cold soil may respond well to a high-phosphorus starter solution.										
ROTS	50	150	100	50	25	200	150	100	50	Broadcast and disk
	30	0	0	0	0	0	0	0	0	Side-dress 4 weeks after seeding
Total	80	150	100	50	25	200	150	100	50	
ndy soils an additional 30 pounds of nitrogen per acre may be applied as a sidedress between 7 and 8 weeks after seeding.										

TABLE 2. FERTILIZER RECOMMENDATIONS FOR VEGETABLE CROPS (continued)

Crop		Recommended application rate based on soil tests									
			Phosphorus (P_2O_5)				Potassium (K_2O)				
			Fertility group				Fertility group				
Crop		Nitrogen (N)	A	B	C	D	A	B	C	D	Suggested application method
			pounds per acre								
CELERY		100	250	200	150	100	300	200	100	50	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress 4 weeks after plantir
		25	0	0	0	0	0	0	0	0	Side-dress 8 weeks after plantir
	Total	150	250	200	150	100	300	200	100	50	
Because celery has a high moisture requirement, irrigation is essential for commercial production. Use of a starter solution is rc m mended when transplanting celery.											
CUCUMBERS		50	100	50	0	0	150	100	50	0	Broadcast and plow down
		25	50	50	50	25	50	50	50	50	Band 2 in. × 2 in. at seeding
		25	0	0	0	0	0	0	0	0	Side-dress when vines start to r
	Total	100	150	100	50	25	200	150	100	50	
EGGPLANT		75	200	150	100	50	250	150	100	50	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress 4 weeks after plantin
		25	0	0	0	0	0	0	0	0	Side-dress 8 weeks after plantin
	Total	125	200	150	100	50	250	150	100	50	
Use of a starter solution is recommended when transplanting eggplant.											
HORSERADISH		150	250	200	100	50	250	200	100	50	Broadcast and disk
LETTUCE (LEAF), ENDIVE, AND ESCAROLE		80	200	100	50	25	200	100	50	25	Broadcast and disk
		40	0	0	0	0	0	0	0	0	Side-dress 3 to 5 weeks after plai n.
	Total	120	200	100	50	25	200	100	50	25	
Apply only 75 pounds of nitrogen per acre to head lettuce because excessive nitrogen may result in loose heads.											
MUSKMELON		50	150	100	50	0	150	100	50	0	Broadcast and plow down
		25	50	50	50	50	50	50	50	50	Band 2 in. × 2 in. at seeding
		25	0	0	0	0	0	0	0	0	Side-dress when vines start to ru
	Total	100	200	150	100	50	200	150	100	50	
The use of black plastic mulch reduces leaching and may therefore make nitrogen sidedressings unnecessary on mineral soils.											
ONIONS		75	200	100	50	25	200	100	50	25	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress 4 to 5 weeks after plai 1g
	Total	100	200	100	50	25	200	100	50	25	
For green onions an additional 25 pounds of nitrogen per acre can be applied as a sidedress from 4 to 5 weeks before harvest.											
PARSLEY		75	200	150	100	50	200	150	100	50	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress at each cutting
	Total	100	200	150	100	50	200	150	100	50	
PEAS		0	100	50	25	0	100	75	50	25	Broadcast and disk
		50	50	50	50	50	50	25	25	25	Band 2 in. × 2 in. at seeding
	Total	50	150	100	75	50	150	100	75	50	
After periods of heavy rains in the spring an additional 30 pounds of nitrogen per acre can be applied when peas are 4 to 6 inches ll. Apply only when the plants are dry to avoid burning the foliage.											
PEPPERS		75	200	150	100	50	250	150	100	50	Broadcast and disk
		50	0	0	0	0	0	0	0	0	Side-dress after first fruit set
	Total	125	200	150	100	50	250	150	100	50	
In sandy soils an additional 25 pounds of nitrogen may be applied as a sidedress after the first harvest. The use of a starter solu r is recommended when transplanting peppers.											
POTATOES		0	150	100	0	0	200	150	100	50	Broadcast and disk
		100	100	100	100	100	100	100	100	50	Band-place at planting
		50	0	0	0	0	0	0	0	0	Side-dress at emergence
	Total	150	250	200	100	100	300	250	200	100	
In sandy soils an additional 30 pounds of nitrogen can be applied as a sidedress before the plants are about 8 or 10 inches tall. n soils with magnesium test values less than 250 pounds per acre, apply 50 pounds of magnesium per acre at planting.											

TABLE 2. FERTILIZER RECOMMENDATIONS FOR VEGETABLE CROPS (continued)

Crop	Nitrogen (N)	Phosphorus (P_2O_5) Fertility group A	B	C	D	Potassium (K_2O) Fertility group A	B	C	D	Suggested application method
	pounds per acre									
PMPKINS	75	150	100	50	25	250	200	150	100	Broadcast and disk
	25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
Total	100	150	100	50	25	250	200	150	100	
E:essive use of nitrogen may result in thin walls and a flat side.										
RUBARB										
New plantings	50	250	200	150	100	250	200	150	50	Broadcast and plow down
	50	0	0	0	0	0	0	0	0	Side-dress around each hill 2 weeks after growth starts
Total	100	250	200	150	100	250	200	150	50	
Cutting beds	50	200	150	100	50	250	150	100	50	Side-dress each hill in early spring
	50	0	0	0	0	0	0	0	0	Side-dress at first harvest
	50	50	50	50	50	50	50	50	50	Side-dress at last harvest
Total	150	250	200	150	100	300	200	150	100	
SINACH	100	200	150	100	50	200	150	100	50	Broadcast and disk
	20	0	0	0	0	0	0	0	0	Side-dress 4 to 5 weeks after planting
Total	120	200	150	100	50	200	150	100	50	
SUASH	75	150	100	50	25	200	100	50	25	Broadcast and disk
	25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
Total	100	150	100	50	25	200	100	50	25	
SEET CORN	100	150	100	75	50	150	100	75	50	Broadcast and disk
	30	0	0	0	0	0	0	0	0	Side-dress when corn is 12 in. tall
Total	130	150	100	75	50	150	100	75	50	
TOMATOES — Fresh Market										
On sandy soils	100	250	200	100	50	300	200	100	50	Broadcast and plow down
	25	0	0	0	0	0	0	0	0	Side-dress at first cultivation
	25	0	0	0	0	0	0	0	0	Side-dress after first fruit set
Total	150	250	200	100	50	300	200	100	50	
On loams	75	250	200	100	50	300	200	100	50	Broadcast and plow down
	25	0	0	0	0	0	0	0	0	Side-dress at first cultivation
	25	0	0	0	0	0	0	0	0	Side-dress after first fruit set
Total	125	250	200	100	50	300	200	100	50	
The second sidedress may not be required on early or semideterminate tomatoes. The use of a starter solution is recommended when transplanting tomatoes.										
WATERMELONS	50	150	100	50	0	150	100	50	0	Broadcast and plow down
	25	50	50	50	50	50	50	50	50	Band 2 in. × 2 in. at seeding
	25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
Total	100	200	150	100	50	200	150	100	50	
The use of black plastic mulch reduces leaching and may therefore make nitrogen sidedressings unnecessary on mineral soils.										

This circular was prepared by John M. Gerber, Extension Specialist in Vegetable Crops, and John M. Swiader, Assistant Professor of Horticulture, University of Illinois at Urbana-Champaign.

1981 Insect Pest Management Guide

COMMERCIAL VEGETABLE CROPS AND GREENHOUSE VEGETABLES

Restricted-use insecticides are identified with an asterisk (*).
You must be certified as a pesticide applicator to use restricted-use pesticides.
See your county Extension adviser in agriculture for information.

COMMERCIAL VEGETABLE GARDENERS find it impossible to produce vegetables profitably unless they control insects at maximum efficiency and minimum cost. The housewife of today will not accept unsightly wormy vegetables; not only are wormy fruits and vegetables unappetizing but the waste from trimming increases food costs. Thus the commercial vegetable gardener must produce a quality product that is acceptable and safe to the consumer. Careful use of the right insecticides will enable him to do this.

Insect pest-management programs, which include the wise selection of cultural, mechanical, biological, and chemical methods, are suggested for the major insect pests of vegetable crops. Insecticides, though, are still the most efficient means of managing most insects.

This suggested insecticide guide has been prepared for use by Illinois commercial vegetable farmers; it is not for home gardeners, who should use only those insecticides that are extremely safe to handle, apply, and store. Furthermore, the commercial vegetable gardener must use a wider variety of insecticides than the home gardener in order to obtain maximum insect control at the least cost.

In using insecticides, read the label and carefully follow the instructions. Do not exceed maximum rates suggested; observe carefully the interval between application and harvest, and apply only to crops for which use has been approved. Make a record of the product used, the trade name, the percentage content of the insecticide, the dilution, the rate of application per acre, and the dates of application.

Some of the insecticides suggested here can be poisonous to the applicator. In using them, the commercial grower is expected to use precautions to protect himself, his workers, and his family from undue or needless exposure.

In using this guide, always refer to the table on the next page, which lists the limitations and restrictions on use. These limitations apply to the vegetables as human food. If you use any portion of a vegetable for livestock food (tops, stalks, etc.), refer to the label for instructions as to the interval required between application and feeding.

The chemical names used in these tables may be unfamiliar to you. These names are the common coded chemical names and as such are not capitalized. Trade names are capitalized. In the table of limitations the common names are listed first. If the trade name is more commonly used, it is listed in parentheses following the common name. Throughout the tables of suggestions, however, the common name is used if there is one. In case you have a question, refer to the table of limitations.

These suggestions are subject to change without notification during the growing season.

Requested label clearances for a few uses of insecticides, carriers, and solvents are uncertain for 1981, since many requests have not been officially cleared. Anticipating needed changes in labeling, we began modifying these suggested uses a few years ago.

Check with your county Extension adviser if you are in doubt about the insecticide you plan to use. We will make announcements of label changes through newsletters and the news media to keep you up to date.

Insecticides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. A person wishing to use an insecticide classified for restricted use must be certified as a private or commercial pesticide applicator by the Illinois Department of Agriculture. Contact your county Extension adviser in agriculture for details on this program.

A few insecticides have been classified at this time. More will be classified later.

Suggestions for the effective use of insecticides from a practical standpoint are based on available data. Soil textures, pH of the soil, rainfall, slope of the field, wind velocity at planting, method and accuracy of application, and other unpredictable factors affect efficiency.

This publication was prepared by entomologists of the University of Illinois College of Agriculture and the Illinois Natural History Survey.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
In cooperation with ILLINOIS NATURAL HISTORY SURVEY CIRCULAR 897 (revised annually) November, 19

LIMITATIONS FOR FIELD VEGETABLES IN DAYS BETWEEN APPLICATION AND HARVEST AND OTHER RESTRICTIONS ON USE OF INSECTICIDES IN ILLINOIS

(Blank spaces indicate that the material is not suggested for the specific use in Illinois)

secticide	Beans	Peas	Broccoli	Brussels sprouts	Cabbage	Cauliflower	Horseradish	Radish	Turnip	Onions	Eggplant	Peppers	Tomatoes
cephate (Orthene)	14	...	..	..	..	..	..	..	....	....	..	7	..
zinphosmethyl (Guthion)[2]	..	...	15	7	21	15	..	..	....	....	..	..	..
acillus thuringiensis[3]	..	...	0	0	0	0	..	..	....	....	..	..	0
rbaryl (Sevin)	0	...	3	3	3	3	3	3	3, 14A	....	0	0	0
rbofuran (Furadan)	..	...	..	..	..	..	..	..	....	....	..	21B	..
asanit	..	...	..	..	..	..	..	..	....	C, D	..	..	..
emeton (Systox)	..	...	..	..	..	..	..	..	....	....	..	3	..
azinon	..	...	5	..	7	5	..	10	10	10	..	..	1
cofol (Kelthane)	7E	...	..	..	..	..	..	..	....	....	2	2	2
methoate (Cygon)	0E	0E	7	..	3	7	..	..	14	....	..	0	7
yfonate	..	...	C	..	C	C	..	..	....	C, D	..	..	..
hion	..	...	..	..	..	..	..	..	....	C	..	..	..
alathion	1	...	3	7	7	7	7	7	3	3	3	3	1
ethomyl (Lannate)	1	1, 5A	3	3	1	3	..	..	....	....	..	10	2
evinphos (Phosdrin)[2]	..	...	1	3	1	3	..	..	3	....	..	..	..
onitor	..	...	21	21	35	28	..	..	....	....	..	..	..
aled (Dibrom)	..	...	1	1	1	1	..	..	4	....	..	..	..
xydemetonmethyl (Meta-Systox R)	..	...	..	..	..	..	..	..	....	....	7F	0B	..
arathion[2]	7	...	7	7	10	7	..	15	10	....	15	15	10
horate (Thimet)[2]	C	...	..	..	..	..	..	..	....	....	..	..	..
tenone	..	...	..	..	..	..	..	..	....	....	1	1	1
ichlorfon (Dylox)	..	...	..	21	21	21	..	..	28E	....	..	21	21

secticide	Potatoes	Collards	Kale	Lettuce	Spinach	Swiss chard	Sweet corn	Cucumbers[1]	Melons[1]	Pumpkins[1]	Squash[1] Winter	Squash[1] Summer
acillus thuringiensis[3]	..	0	0	0	0	..	..	..	..	..	..	..
rbaryl (Sevin)	0	14	14	14	14	14	0	0	0	0	0	0
rbofuran (Furadan)	14H	..	..	..	..	..	..	..	..	..	..	..
azinon	..	10	10	10	10	12	C	7	3	..	3	7
cofol (Kelthane)	..	..	..	..	..	..	..	2	2	2	2	2
methoate (Cygon)	0	14	14	14	14	14	..	..	3	..	..	..
yfonate	..	..	..	..	..	..	C	..	..	..	..	..
alathion	0	7	7	14	7	7	5	1	1	3	1	1
ethomyl (Lannate)	6	..	..	10	7	..	0, 3A	3	3	..	..	3
evinphos (Phosdrin)[2]	..	3	3	2	4	..	..	..	..	..	..	..
ocap	..	..	..	..	..	..	C	..	..	..	..	..
aled (Dibrom)	..	4	4	1	1	1	..	..	..	..	..	..
arathion[2]	5	10	10	21	14	21	12	15	7	10	15	15
horate (Thimet)[2]	C	..	..	..	..	..	C	..	..	..	..	..
tenone	..	1	1	1	1	1	..	..	..	..	..	..
rbufos (Counter)	..	..	..	..	..	..	C	..	..	..	..	..
ichlorfon (Dylox)	..	28G	21	28G	..	..	..	..	..	3F	..	..

se restricted to certified applicators only.

pply insecticides late in the day after the blossoms have closed reduce bee kill.

or use only by professional applicators or commercial gardeners. he trade names are Bactur, Dipel, and Thuricide.

A. If tops or stover are to be used for feed.
B. Not more than twice per season.
C. Soil applications at planting time only.
D. Do not use on green onion crop.
E. Do not use tops for feed or food.
F. Not more than 3 times per season.
G. Not after edible portions or heads begin to form.
H. Not more than 8 times per season.

REENTRY INTERVALS FOR WORKER PROTECTION

Insecticide	Hours
azinphosmethyl (Guthion)	24
demeton (Systox)	48
ethion	24
parathion	48

orkers must wear protective clothing if they enter treated ds before the time intervals shown at the right. They must o wear protective clothing for all other insecticides applied he spray has not dried or the dust has not settled.

CABBAGE AND RELATED COLE CROPS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Cabbage maggots[1] (NHE-44)	All season	diazinon Dyfonate	3 2	Broadcast	Disk in just before planting. Use cabbage, cauliflower, and broccoli
		diazinon granules	1	Furrow	At time of planting; on turnips a ing spray of 1 lb. diazinon sh applied 30 days following treatme
		*azinphosmethyl diazinon	3 oz. W.P. or 2 oz. E.C. per 50 gal. transplant water 4 oz. per 50 gal. transplant water		6 fluid oz. transplant water per
Aphids (NHE-47) Thrips (NHE-48)	All season	*azinphosmethyl dimethoate malathion *mevinphos *parathion	¾ 0.3 1 ¼ 0.4	Foliage	When aphids appear, but before begin to curl.
Cabbage loopers (NHE-45); diamond-back moth larvae; imported cabbage worms	All season	*Bacillus thuringiensis* *methomyl *Monitor	See rates on label 0.45-0.9 1	Foliage	When small worms first appe about every 5 to 7 days thereafte ough spray coverage of foliage portant.
Cutworms	At planting	trichlorfon	1	Soil	At planting, at base of plant or as when damage first occurs.
Flea beetles and leafhoppers	All season	carbaryl	1½	Foliage	As needed.

E.C. = emulsion concentrate; W.P. = wettable powder.

* Use restricted to certified applicators only. [1] Maggots are resistant to diazinon in some areas of Illinois.

COLLARDS, KALE, LETTUCE, SPINACH, SWISS CHARD

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Aphids (NHE-47)	All season	diazinon dimethoate *mevinphos naled *parathion	½ 0.3 ¼ 1 0.4	Foliage	As needed.
Cutworms	On seedling plants	trichlorfon[1]	1	Base of plant and soil	When first damage appears.
Leafhoppers	All season	carbaryl dimethoate malathion	1½ 0.3 1	Foliage	When first leafhoppers appear, a needed.
Caterpillars (NHE-45)	All season	*Bacillus thuringiensis* *methomyl[2] naled	See rates on label 0.45 1	Foliage	When small worms first appear and 5 to 7 days thereafter.
Leaf miners	All season	diazinon dimethoate *parathion	½ 0.3 0.4	Foliage	When first miners are observed.
Flea beetles	All season	carbaryl rotenone	1 ¼	Foliage	As needed.

* Use restricted to certified applicators only.

[1] Do not use on spinach or Swiss chard.
[2] Use limited to lettuce and spinach only.

BEANS

sect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
ed maggots (HE-27)	All season	diazinon 50% W.P.[1] Lorsban 25% W.P.[1]	3/5 oz./bu. 2 oz./bu.	Seed Seed	Treat seed no longer than 3 months before planting.
		phorate granules	1½	Soilband	Place on either or both sides of row at planting but not in contact with seed.
an leaf beetles (HE-67)	Early and late season	carbaryl malathion	1 1	Foliage	When feeding first appears and weekly for 2 or 3 applications as needed.
afhoppers (HE-22) and nt bugs (HE-68)	All season	carbaryl dimethoate malathion *methomyl	1 0.3 1 0.45	Foliage	Before plants become yellow and stunted. Repeat applications at weekly intervals as necessary.
		phorate granules	1½	Soilband	As for seed maggot.
exican bean etles	Midseason and late season	carbaryl malathion	½ 1	Foliage	When occasional leaves show lacework feeding.
		phorate granules	1½	Soilband	As for seed maggot.
hids (NHE-47)	All season	dimethoate malathion	0.3 1	Foliage	Usually applied when a few aphids can be found on each plant, but before leaves begin to curl and deform.
		phorate granules	1½	Soilband	As for seed maggot.
ster beetles (HE-72)	Midseason and late season	carbaryl	1½	Foliage	As needed.
rn earworms (HE-33) rn borers	Late season	acephate carbaryl *methomyl *parathion	⅔ 1½ 0.45 ½	Foliage	As needed, but usually after August 20. Worms may be present before bloom.
tes	Midseason and late season	dicofol dimethoate malathion	0.4 0.3 1	Foliage	As needed, but especially during drouthy periods particularly if carbaryl has been used on crops.
		phorate granules	1½	Soilband	As for seed maggot.

*se restricted to certified applicators only. [1] No restrictions when used as recommended.

CUCUMBERS AND OTHER VINE CROPS[1]

sect	Time of attack	Insecticide[2]	Pounds of active ingredient per acre	Placement	Timing of application[1]
iped and otted cucumber etles (NHE-46)	Seedling to mature plants	carbaryl *parathion	1 ½	Foliage	When beetles first appear; as often as necessary thereafter.
hids (NHE-47)	All season	diazinon dimethoate[2] malathion *parathion	½ 0.3 1 ½	Foliage	When aphids become noticeable.
uash bugs (HE-51)	All season	*parathion trichlorfon[3]	½ 1	Foliage	Do not apply until first eggs are found hatching (about June 15 to July 15); controls only nymphs.
afhoppers	July-August	malathion dimethoate[2]	1 0.3	Foliage	As needed.
uash vine ers	June-September	carbaryl	1	Base of stem for 3 ft.	Weekly applications when vines begin to run—usually 5 applications.
kle worms	August-September	carbaryl	1	Foliage	Weekly applications, beginning in late August.
tes	July-September	dicofol malathion *parathion	½ 1 ½	Foliage	As needed.
tworms (HE-77)	April-June	carbaryl	2	Base of plants	As needed.

*se restricted to certified applicators only.

[1] pray vine crops with insecticide only late in the day after blossoms have closed to reduce bee kill. [2] Do not use dimethoate on cucumbers.
[3] umpkin is the only vine crop for which trichlorfon can be used for squash bug control.

TOMATOES AND EGGPLANT

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Cutworms (NHE-77)	Early and midseason	carbaryl trichlorfon	2 1	Base of plants or foliage	As needed.
Flea beetles	May-June	carbaryl rotenone	2 0.2-0.4	Foliage	Apply every week as long as needed
Aphids (NHE-47)	May-July	diazinon dimethoate[1] malathion *parathion	½ 0.3 1 0.4	Foliage	As needed, but before leaves curl.
Cabbage loopers	July-September	*Bacillus thuringiensis* *methomyl	See rates on label 0.45-0.9	Foliage	When loopers are present.
Corn earworms Corn borers Hornworms	July-September	carbaryl *methomyl[1]	2 0.45-0.9	Foliage	Add to weekly applications of fungicide sprays beginning at first fruit set when first small worms appear.
Mites	July-September	carbophenothion dicofol malathion *parathion	1 ½ 1 0.4	Foliage	As needed.
Russet mites	July-September	*parathion sulfur dust[2] sulfur spray[2]	0.4 10 10	Foliage	As needed.
Blister beetles (NHE-72)	June-September	carbaryl *parathion	1½ ¼	Foliage	As needed.
Fruit flies and picnic beetles	August-October	carbaryl diazinon	2 ½	Foliage	When flies or beetles first appear.

* Use restricted to certified applicators only. [1] Use cleared only on tomatoes. [2] No limitations on use.

PEPPERS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Aphids (NHE-47)	May-July	dimethoate demeton *methomyl oxydemetonmethyl acephate	0.3 ⅜ 0.45 ½ ½	Foliage	Only when aphids are present. Add to borer spray when it is being used.
Corn borers	Late season	carbaryl acephate	2 1	Foliage and fruit	When fruit is present on plant. Apply every 5 days when borers are present.
		carbofuran	2-3	Soilband to transplant	Make 2 applications; first, 3 weeks after transplant, second, 5 weeks later.

* Use restricted to certified applicators only.

ASPARAGUS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Asparagus beetles (NHE-49)	Early and midseason on spears and ferns	carbaryl[1] malathion[1]	1½ 1	Spears and ferns	As needed, not more often than every days.
		rotenone[1]	0.2-0.4	Spears	As needed.

[1] One-day restriction between last application and harvest.

SWEET CORN

sect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Sl insects (HE-26, 27, 43)	April-August	Counter diazinon Dyfonate Mocap phorate	1 1 1 1 1	Row	Apply on soil surface behind planter shoe and ahead of press wheel. Rootworm control may be needed if the corn was not sprayed the previous year.
(tworms (HE-38)	April-June	carbaryl[1] carbaryl bait	2-3 1	Base of plants	When first damage appears.
a beetles (HE-36)	April-July	carbaryl[1]	1½	Foliage	As necessary.
panese beetles (HE-32)	July-September	carbaryl[1]	1	Ear zone	As necessary.
st-generation cn borers	June	carbaryl[1]	2	Foliage	Make first application when tassel ratio is 30 to 40. Repeat in 4 to 5 days.
Sond-generation cn borers and cn earworms[2] (HE-33)	June-September	carbaryl[1] *methomyl	2 0.45	Ear zone	*Fresh market corn:* At first silk and every 2 to 3 days for 5 to 8 applications. *Canning corn:* Observe light traps for earworm and borer adults, or keep a record of the heat units. When 1,500 or more heat units have accumulated, begin a spray program. As an alternative, begin at 30 to 50% silk and every 3 days thereafter until the corn is within 8 to 12 days of harvest.
S beetles (HE-10) Pnic beetles	July-September	carbaryl[1] diazinon malathion *parathion	2 1 1 ½	Foliage	When adults first appear in field; usually between pollen-shedding and silk-drying.
Cn leaf aphids (HE-29)	July-September	malathion *parathion	1 ½	Foliage	As needed to produce attractive ears for fresh market.
Fl armyworms	July-September	*methomyl *parathion	0.45 ½	Foliage	Apply to ear zone when whorl feeding is evident.

* se restricted to certified applicators only.

[1] ring pollen shed, apply carbaryl as late in the day as possible (preferably after 4 p.m.) to reduce bee kill. [2] Adding 0.5 to 0.75 pound of pathion or 0.25 to 0.45 pound of methomyl to carbaryl improves earworm control.

ONIONS

ect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Oon maggots (HE-50)	All season	diazinon W.P. ethion W.P.	½-1 for 40-50 lb. of seed 1 for 40-50 lb. of seed	Seed	Seed treatment for set onions only. Use lighter dosage of diazinon on sandy, highly mineral soils.
		Dasanit granules diazinon granules Dyfonate ethion granules	1 ½-1 1 ½-2	Furrow	Use 1 lb. active ingredient per acre for rows 12″ apart; ¾ lb. for rows 18″ apart; ½ lb. for rows 24″ apart. Up to twice these amounts are needed for ethion on muck soils. Do not use Dasanit or Dyfonate on green onions.
		diazinon	2	Broadcast	Preplanting; disk into upper 1 to 2 inches of soil. Supplement with foliage spray below.
		diazinon malathion	⅓ 1	Foliage	Supplemental to soil treatment. Make first application when first adult flies are seen; make another 1 week later. From then on only as necessary.
Tips (NHE-48)	Midseason and late season	diazinon malathion *azinphosmethyl	½ 1 ½	Foliage	When injury first appears and every 10 days as necessary.

* e restricted to certified applicators only.

POTATOES

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Flea beetles	May-July	carbaryl	1	Foliage	When damage first appears on the leaves. Repeat as needed.
		carbofuran granules	3	In furrow	Planting time.
		carbofuran spray	1	Foliage	As needed.
		*methomyl	0.45	Foliage	As needed.
Colorado potato beetles; cutworms; potato leafhoppers (NHE-22)	May-July	carbaryl	2	Foliage	As needed.
		carbofuran granules	3	In furrow	Planting time.
		carbofuran spray	1	Foliage	As needed.
		dimethoate	0.3	Foliage	As needed.
		phorate granules	2-3	Soilband	Place on either or both sides of row at planting, but not in contact with seed. Use the lower rate on sandy soils, the heavier rate on heavy soils. Do not use on muck soils.
Aphids (NHE-47)	All season	dimethoate	0.3	Foliage	As needed.
		*methomyl	0.45		
		*parathion	¼		
		phorate granules	2-3	Soilband	Same as for leafhoppers.
Blister beetles (NHE-72)	All season	carbaryl	1½	Foliage	As needed.
Wireworms (NHE-43) White grubs (NHE-23)	All season	phorate granules	2-3	Soil	Preplanting, disk in; or use as soilband at planting.
Grasshoppers (NHE-74)	July-September	carbaryl	¾	Foliage	As needed, control in fence rows, roadsides, ditch banks, etc., before migration.
		dimethoate	0.3		

* Use restricted to certified applicators only.

PEAS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Caterpillars, including loopers	June	*methomyl	½-1	Foliage	Before harvest if worms are present.
Aphids	May-June	dimethoate	⅓	Foliage	As needed.

* Use restricted to certified applicators only.

Limitations for Greenhouse Tomatoes

Insecticide	Tomatoes
endosulfan (Thiodan)	15 hours
malathion	15 hours
metaldehyde	As bait applied only to soil
naled (Dibrom)	1 day
*parathion[1]	10 days

* Use restricted to certified applicators only.

[1] Do not use aerosols that contain parathion or the propellant methyl chloride in greenhouses connected to living quarters.

GREENHOUSE TOMATOES

nsect	Insecticide[1]	Dosage and formulation	Application
,phids Vhiteflies	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	naled vapor	5 oz. of 4% E.C. per 50,000 cu. ft.	Apply on steampipes.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
lealybugs pider mites usset mites hrips		Use malathion or parathion aerosol as suggested for aphid and whitefly.	
rmyworms abbage loopers utworms omato fruitworms	malathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
	*parathion aerosol	1 lb. 10% aerosol per 50,000 cu. ft.	In a closed greenhouse above plants.
ugs	metaldehyde	Commercially prepared bait or spray	To mulch on soil surface. Do not contaminate edible parts.

Use restricted to certified applicators only.

;ee page 78 for limitations between application and harvest.

FOR ADDITIONAL INFORMATION

Obtain the following circulars on insect control from e Office of Agricultural Publications, 123 Mumford all, Urbana, Illinois 61801.

ircular 899, 1981 Insect Pest Management Guide — Field and Forage Crops

ircular 900, 1981 Insect Pest Management Guide — Home, Yard, and Garden

rcular 1076, 1981 Turfgrass Pest Control

Leaflets describing the life history, biology, and habits of some of the insects mentioned can be obtained from the offices of county Extension advisers or by writing to Entomology Extension, 172 Natural Resources Building, Urbana, Illinois 61801. These are indicated by an NHE number in the tables.

FOR YOUR PROTECTION

Always handle insecticides with respect. The persons ɒst likely to suffer ill effects from insecticides are the ɛplicator and his family. Accidents and careless, needless ɛerexposure can be avoided. Here are a few easy rules ɪat if followed will prevent most insecticide accidents:

1. Wear rubber gloves when handling insecticide concntrates.

2. Do not smoke while handling or using insecticides.

3. Keep your face turned to one side when opening insticide containers.

4. Leave unused insecticides in their original containers vth the labels on them.

5. Store insecticides out of reach of children, irresponsle persons, or animals; store preferably in a locked ɔinet.

6. Triple-rinse and bury or burn all empty insecticide ntainers or take to an approved sanitary landfill.

7. Do not put the water-supply hose directly into the sray tank.

8. Do not blow out clogged nozzles or spray lines with your mouth.

9. Wash with soap and water exposed parts of body and clothes contaminated with insecticide.

10. Do not leave puddles of spray on impervious surfaces.

11. Do not apply to fish-bearing or other water supplies.

12. Do not apply insecticides, except in an emergency, to areas with abundant wildlife or to blossoming crops visited by bees. Avoid drift onto blossoming crops or onto bee hives.

13. Do not apply insecticides near dug wells or cisterns.

14. Do not spray when weather conditions favor drift.

15. Observe all precautions listed on the label.

16. To avoid bee kill, apply insecticides after bee activity has been completed for the day; use the least toxic materials. *Warn beekeepers that you are applying insecticides.*

1981 Disease Management Guide for Commercial Vegetable Growers

The successful control of vegetable diseases requires the use on an integrated basis of resistant varieties, disease-certification programs, crop rotations, balanced soil fertility, weed and insect control, proper crop culture; also, the use of fungicides, bactericides, or nematicides. Economical disease control requires an overall management system for the entire farm. Recordkeeping is necessary concerning which crops have been planted, what problems occurred, and what pesticides were used.

This circular presents information updated annually about disease management for vegetables. The information given should be used in conjunction with the current versions of Circular 897, *Insect Pest Management Guide — Commercial Vegetable Crops and Greenhouse Vegetables,* and Circular 907, *Herbicide Guide for Commercial Vegetable Growers.* Those circulars are also revised each year.

Since many disease problems originate with seeds or transplants, growers should follow the recommendations about seed treatments. Otherwise, be sure to obtain planting material that is certified as being free of disease.

Vegetable fungicide tolerances and intervals approved by the Food and Drug Administration and the Environmental Protection Agency as of October 1, 1980, are presented in this publication. The tables on fungicide uses and label information give the tolerances in parts per million (ppm) and the number of days between the last application at the normal rate and the harvest *or* they give the date for a last application that will keep residues within the tolerances set by the FDA.

The listing of a chemical for a crop does not necessarily constitute a recommendation for the control of a disease on that crop by the Illinois Cooperative Extension Service or Agricultural Experiment Station. Specific recommendations are given in the table called "Cc densed Recommendations . . ."

In some instances, a tolerance (ppm) has been but a definite interval has not been established. T absence of an interval does not mean necessarily that t fungicide may not be used on that crop. The use of t fungicide would require such restrictions as "do r apply after first blooms appear" or "do not apply af edible parts form."

In a few cases, the interval and dosage have be established but the allowable ppm residue has not be determined. Here again, this does not mean that t fungicide may not be used on that crop. It does mea however, that until one is established the tolerance mu be considered as zero. Zero tolerances are reviewed ea year. Some are cancelled as the manufacturer suppl the EPA with additional data.

Growers must follow a program of disease contr that will assure the production of vegetables with no e cessive fungicide residues. Vegetables marketed wi residues exceeding the FDA tolerances may be injurio to consumers, may be confiscated, and may cause t grower to be brought to court.

Growers have nothing to fear from the law as lo as they use fungicides and other pesticides according the current label and only on the crops specified, in t amounts specified, and at the times specified. The sa grower keeps a record of the products and trade nam used, the percentage of active ingredients, dilutions, rat of application per acre, and dates of application. T record sheet provided on the last page provides a co venient place to keep such information.

This circular is revised each year. Be sure you a using the most up-to-date copy.

THIS PUBLICATION REPLACES CIRCULAR 999

Prepared by Barry Jacobsen, M. C. Shurtleff, and Molly Niedbalski Cline, Department of Plant Pathology

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVIC

Urbana, Illinois Circular 1184 (revised annually) November, 198

FUNGICIDE USES AND RESIDUE INFORMATION FOR VEGETABLES APPROVED BY THE EPA, OCTOBER 1, 1980[a, b]

Crop	Benlate, 0.2-50 ppm	Captan (D) 2-100 ppm	Bravo, 0.5-15 ppm	Difolatan, 0.1-15 ppm	Dyrene, 0.1-10 ppm	maneb, 4-45 ppm maneb with zinc salt	mancozeb[c] 0.1-15 ppm	zineb, 4-25 ppm
Asjragus	. .	root dip	. .	. .	. .	A[d]	A	A
Be:s (dry, lima, sip)	(2 ppm-beans) 14,[e] B; (50 ppm-forage)	pp, 0[e]	7,[e] B (snap only)	. .	. .	0[e] 4 on limas or snap	. .	7[e]
'na	28							
'e garden	. .	(2 ppm-root, 100 ppm-greens) 0, pp	. .	. .	. .	. .	. .	(7 ppm-roots); (25 ppm-tops) 7
r coli	. .	pp	0[e]	. .	. .	3, or trim and wash, 0	. .	7
3r sels sprouts	. .	pp	0	. .	. .	. .	. .	7
'a)age	. .	pp	0	. .	. .	7	. .	7
'a:aloupe nuskmelon)	0	0, ph,[d] pp	0	0[e]	0[e]	5	(0 ppm in edible parts) 5[e]	5
'a:ot	. .	0	0	. .	. .	0	7, B (tops)	7 (tops)
'a iflower	. .	pp	0	. .	. .	0	. .	7
'e ry	7	0, pb	7	. .	0	strip and wash, 14	14	strip and wash, 14
'hese cabbage	. .	. .	. .	. .	. .	. .	. .	7
'a, sweet and pop	. .	10, B, pp	14, B[f]	. .	. .	0, B, C	(0.5 ppm-cob and kernel), 7 (15 ppm-fodder and forage, 0.5 ppm-ears) 5	0, B, C
'umber	0	0, ph, pp	0	0	0	5	. .	5
:plant	. .	0, ph, pb	. .	. .	. .	0	. .	0
:.ive, escarole	. .	. .	. .	. .	. .	10, and wash	. .	10
'nel	. .	. .	. .	. .	. .	. .	7	. .
<e, collard	. .	pp	. .	. .	. .	10, and wash	. .	10
'ilrabi	. .	pp	. .	. .	. .	0	. .	(halfgrown)
.tuce	. .	0	. .	. .	. .	10, strip and wash	. .	10
stard greens	. .	pp	. .	. .	. .	10, and wash	. .	10
on	. .	(50 ppm-green, 25 dry) 0, ph	(5 ppm-green) 14; (0.5 ppm-dry) 7	. .	0	0	(0.5 ppm dry), 7, D	7
's	. .	pp	. .	. .	. .	. .	. .	10
'per	. .	0, pb, pp	. .	. .	. .	0	. .	0
'ato, Irish[d]	. .	0, ph	0	0	0	0, C	0	0 and seed, C, pp
npkin	. .	0, pp	0	. .	0	0	. .	0
lish	. .	. .	. .	. .	0	. .	. .	0
ıbarb (greenhouse)	. .	0	. .	. .	. .	0	. .	. .
nach	. .	0, pp	. .	. .	. .	10, and wash	. .	10
ıash	0	0, pp	0	. .	0	(4 ppm-roots) 5; (45 ppm-tops), 10, B, C, 14, no feeding restrictions	5	5
gar beet[d]	(0.2 ppm-roots, 15 ppm-tops) 21	0	. .	. .	. .	. .	(2 ppm-roots, 65 ppm-tops), B, 14	. .
iss chard	. .	0	. .	. .	. .	. .	. .	7
mato	0	0, pp	0	0[g]	0	(100 ppm-tops) 5, F; (7 ppm-roots) and wash	5	5
rnip, rutabaga	. .	pp	. .	. .	. .	. .	. .	7 (tops)
itermelon	0	0, pp	0	0	0	5	(0 ppm edible parts), 5[e]	5

ɔ tolerances have been set for these fungicides on dill, horseradish, okra, parsley,.and parsnip.
ıe following abbreviations are used:
A = Postharvest application to ferns only or to young plantings that will not be harvested.
B = Do not feed treated tops or forage to livestock.
C = Do not use treated seed or seed pieces for feed or food.
D = Do not apply to exposed bulbs.
E = Do not apply after fruit buds form.
F = To avoid damage, do not use on tender young plants.
pb = Plant bed treatment.
ph = Postharvest spray or dip.
pp = Preplant soil treatment.
ancozeb is sold as Dithane M-45 and Manzate 200.
ɔlerances are not needed for pesticides applied only to the foliage and not translocated to the tubers or roots.
dicates number of days between last application and harvest; 0 = up to harvest.
ɔ not apply if the crop is to be used for processing.
achine harvest only.

LABEL INFORMATION ON FUNGICIDES OF LESS GENERAL USE

Fungicide (tolerance)	Crops and use restrictions
Botran (5-20 ppm)	**Beans** (snap) — white mold, 2 days to harvest. Do not feed forage to livestock. **Greenhouse tomato** — to harvest. Do not drench seedlings or newly set transplants. **Carrot** — postharvest dip or spray, see label. **Garlic, onion** — soil application before seeding or spray to soil around sets or bulbs. *Do not plant spinach* as a followup crop in treated soil. **Leaf lettuce** (greenhouse) — 14 days[a] (do not apply to wilted plants or seedlings). **Head lettuce** — 14 days. **Celery** — 7 days. **Cucumber** (greenhouse) — see label. **Rhubarb** (greenhouse) — 3 days. **Potato** — 14 days (do *not* feed to livestock). **Sweet potato** — root dip and plant bed treatment. Note: Do not plant tomatoes as followup in treated soil. Don't use spent roots for food or feed. Postharvest spray or dip as directed. **Tomato** (greenhouse) — 3 days.
Copper fungicides[b]	
tribasic copper sulfate (Kobasic, Triangle, Tri-basic Copper Sulfate, etc.)	**Been, beet, broccoli, Brussels sprouts, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, potato, pumpkin, radish, spinach, squash, tomato, watermelon.**
copper sulfate (many)	**Bean, broccoli, cabbage, cantaloupe, cassaba melon, cauliflower, celery, cucumber, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, watermelon.**
copper resinate (Citcop 4E, Cop-O-Cide, Emulsifiable Liquid Copper Fungicide)	**Bean, broccoli, cantaloupe, caulifiower, chinese cabbage, carrot, celery, cucumber, honeydew melon, lettuce, muskmelon, onion, pepper, pumpkin, squash, tomato, turnip, watermelon.**
copper ammonium carbonate (Copper-Count N)	**Bean, cabbage, carrot, crenshaw melon, celery, cantaloupe, cassaba melon, cucumber, honeydew melon, lettuce, muskmelon, pepper, Persian melon, potato, squash, tomato, watermelon.**
copper hydroxide (Kocide 101 and 404)	**Bean, broccoli, Brussels sprouts, cabbage, cantaloupe, carrot, celery, cucumber, honeydew melon, muskmelon, pepper, potato, pumpkin, squash, tomato, watermelon.**
copper oxychloride sulfate (COCS, Copro 50 and 53)	**Bean, beet, broccoli, Brussels sprouts, cabbage, cantaloupe, carrot, cassaba melon, cauliflower, celery, crenshaw melon, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, Persian melon, potato, pumpkin, spinach, squash, tomato, watermelon.**
Bordeaux mixture (Acme Bordeaux mixture, Pattersons Bordeaux mixture, Bor-Dox, Ortho Bordo mixture, etc.)	**Asparagus, beans, beets, broccoli, Brussels sprouts, cabbage, carrot, cassaba melon, celery, collards, crenshaw melon, honeydew melon, horseradish, kale, mustard, pepper, rape, rutabaga, spinach, cress, cucumber, eggplant, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, turnip, watermelon.**
fenaminosulf (Lesan)	Cleared *only* for seed-treatment use on b ns, **beets, corn, cucumbers, peas, spinach, sugar** l ts. Do not use treated seed for food, feed, o il. Slurry seed treatment for planting in light ils or soils high in clay or organic matter.
dinocap (Karathane)	**Cantaloupe (muskmelon), cucumber, hone** w **melon, pumpkin, squash, watermelon** — 7 ys. For control of powdery mildew only.
etridiazol (Terrazole, Truban)	Seed treatment: **Beans, peas, sugar beets.**
polyethylene polymer (Polyram) (0 ppm)	**Potato, sugar beet** — no time limitations. **C** — 14 days. **Cantaloupe, cucumber, tomato** days. Do *not* feed sugar beet tops to mea dairy animals. **Celery** — strip, trim, and wa 14 days. Postharvest application to **aspa** ferns.
PCNB (Terraclor, Brassicol, Fungiclor) (0.1 ppm)	**Beans** — base of plants *before* blossoming, and seed treatment at planting, or foliar s Do *not* feed treated **Bean** vines to livestock *not* apply after first bloom. **Broccoli, Br sprouts, cabbage, cauliflower** — transplant tion (¾ pint per plant) or row treatment b transplanting. **Pepper, potato, tomato** — soil t ment at or before planting. **Tomato** (greenh — transplant solution (½ pt. of 0.2% per pl **Garlic** — soil and seed treatment at planting
streptomycin (0.25 ppm)	**Celery, pepper, tomato** — plant beds only ppm spray); **Potato** — seedpiece treatment (100 ppm dip or dust). Soak cut seed pieces than 30 min. **Beans** — seed treatment for blight control. Do not use treated seed for or feed.
sulfur, lime, and lime-sulfur	Exempt when used with good agricultural tices. See label.
thiabendazole (Mertect) (0.02-0.1 ppm)	**Sweet potato** — "seed" root treatment. Do use treated pieces for food or feed. **Pota** "seed" tubers only (1,500 ppm-20 sec. dip). age rot control.
thiram, TMTD (0.5-7 ppm)	**Onion** — Furrow treatment. **Celery** — 7 (strip, trim, and wash). **Sweet potato** — pre root dip. **Tomato** — 0 days, for leaf spots fruit rots. Seed treatment: **Beans, beets, broc Brussels sprouts, cabbage, cantaloupe, ca cauliflower, collard, corn, cucumber, eggp endive, kale, kohlrabi, lettuce, okra, onion** (l seed, and set), **peas, pepper, pumpkin, ra spinach, squash, swiss chard, tomato, tu watermelon.** WARNING: Do not use tre seed for food, feed, or oil — 7 days.
triphenyltin (Du-Ter)	**Carrot** — Alternaria leaf spot and late bligh 14 days. **Potato** — early and late blight. Ma applied through irrigation systems (solid se center pivot only).

[a] Number of days between last application and harvest.
[b] There are many other copper materials, but these are most widely available and labeled for use on vegetable crops. Exempt from tolerance if used with good agr tural practices; not exempt if used at the time of harvest or after harvest. See label.

CONDENSED RECOMMENDATIONS ON DISEASE MANAGEMENT FOR DISEASES OF COMMERCIAL VEGETABLE CROPS FOR 1981

Vegetable	Disease management practices
sparagus	
Crown or root rots, seedling blights, and wilt	No resistant varieties are available for control of these diseases. Treating the crowns with captan or mancozeb may aid in control. These diseases are best managed by good asparagus culture. Provide optimal soil fertility, weed and insect control. Avoid excessive cutting.
Rust, other leaf and branchlet blights	Grow rust-resistant varieties. Apply zineb, maneb, mancozeb, or Polyram to nonharvested fields up to August 15 and to harvested fields after harvest only. Applications should be made on 7- to 10-day intervals.
ans (snap, dry, wax, and lima)	
Most diseases	When possible, use rotations of 2-3 years between bean crops.
Seed decay, damping-off, seed-borne stem blights, and root rots	Plant only western-grown, certified seed in a seed bed that is warm (60°-65° F.) and well-prepared. Seed treatment with thiram, captan, Terrazole, or chloroneb plus insecticide is suggested.
Root rots	Maintain optimal soil fertility. Utilize crop rotations of 2-3 years.
Bacterial blights	Plant only western-grown, certified seed. Utilize crop rotations of 2 to 3 years. Avoid cultivating when beans are wet. Streptomycin may be added to seed treatment fungicide/insecticide. Field applications of 2-3 pounds of fixed copper per acre will provide good control of brown spot and halo blight, only moderate control of common or fuscous blight.
Downy mildew and syringe blight (brown spot) on lima beans	Make early and weekly applications of fixed copper. Eliminate lilac and wild cherry from field borders.
Rust, anthracnose, and other fungal leaf, pod, and stem diseases	Utilize crop rotations of 2-3 years. Apply maneb, zineb, or Bravo at 7- to 10-day intervals. Rust-resistant varieties are available for some types of beans.
White Mold	Apply Benlate or Botran first at initial to 25 percent bloom and again at full bloom. Botran may be used on snap beans only.
Virus diseases	Plant varieties with resistance to bean common mosaic, NY15 strain of common mosaic, and bean yellow mosaic.
Soybean cyst nematode	Rotate 2-3 years with corn, small grains, alfalfa, red clover, or other nonhost crop. Do not include soybeans in the rotation.
eets (garden and sugar), Swiss chard	
Seed rot, damping-off, and seed-borne leaf spot	Sow in a well-prepared seed bed. Treat seed with captan or thiram. Make sure boron levels are adequate.
Cercospora leaf spot	Apply zineb or fixed copper weekly at the first sign of disease.
rucifer crops (broccoli, Brussels sprouts, cauliflower, cabbage, chinese cabbage, collards, kale, kohlrabi, mustard, radish, rutabaga)	
Seed rot, damping-off, black rot, blackleg	Sow only western-grown, hot water-treated seed. Seed also should be treated with thiram or captan. Place seed beds where no crucifer has grown for 4 years or more and where water will not drain from fields recently planted to crucifers.
Wirestem (*Rhizoctonia*)	Incorporate PCNB-captan in upper 3 inches of soil before planting or drench after planting.
Clubroot	Apply PCNB (Terraclor 75) in transplant water.
Black rot and blackleg	Use a crop rotation of 3-4 years or more. Use only hot water-treated seed. Use care in the selection of plant bed sites. Be sure no drainage occurs to seed bed from old plantings. Control wild mustard and other cruciferous weeds. Purchase only certified, disease-free transplants. Do not dip transplants before planting. Sprays of fixed copper may help control black rot. Bravo applied to control downy mildew may also help control blackleg. Some cabbage varieties resistant to black rot are available. Losses are generally lower where direct seeding is used.
Downy mildew, Alternaria leaf spot, and other fungal leaf diseases	Apply maneb, zineb, or Bravo on weekly intervals. Start applications in seed bed or when plants are young.
Tipburn	Plant resistant varieties.
Fusarium yellows	Plant yellows-resistant varieties.
Radish black root	Plant resistant varieties.
arrots, Parsnips	
Seed rot, damping-off, Cercospora leaf spot, Alternaria leaf blight	Treat seed with captan or thiram. Apply maneb, mancozeb, zineb, or Bravo on 7-10 day interval.
Aster yellows	Use insecticides to control leafhoppers that transmit the mycoplasma. Excellent early season leafhopper control is essential. Control must occur *before* leafhoppers feed.
Root-knot nematode	Fumigate mineral soils with D-D, Telone, EDB, or Vorlex. Do not use EDB where onions will be planted within 3 years, *or* practice a 3-year rotation with corn or some other nonhost crop with which broadleaf weed hosts will be controlled.
Parsnip canker	Spray with fixed copper at a 10-day interval in late season (August) until the tops die. Ridge soil over the shoulders.
elery, Parsley	
Seed rot, damping-off, seed-borne leaf blights	Treat plant seed with hot water, then captan or thiram. If damping-off starts, spray 2-3 times, 5-7 days apart with zineb. Seed 2-3 years old is free of late blight.

Vegetable	Disease management practices
Leaf blights and spots	Spray maneb, zineb, Benlate, Dyrene, Bravo, or mancozeb at 7-10 day intervals.
Aster yellows and Root-knot nematode	(See the section on Carrots and Parsnips)
Corn (sweet and pop)	
Seed rot, seedling blights, seed-borne diseases	Plant seed treated with captan, thiram, or Vitavax-thiram and insecticide.
Stewart's disease	Control flea beetles with insecticide, or plant tolerant hybrids.
Smut	Plant tolerant hybrids.
Maize dwarf mosaic, Wheat streak mosaic	Control Johnsongrass and volunteer wheat. Plant wheat after the fly-free date. Some hybri tolerate maize dwarf better than others, but no hybrids are highly resistant.
Helminthosporium leaf blights, anthracnose leaf blight	Spray mancozeb, Polyram, or Bravo when disease first appears. Crop rotation and clean tilla will help reduce disease risk.
Rust	Spray the same as with zineb (see above).
Vine Crops (cucumbers, muskmelons (cantaloupe), pumpkins, squash, and watermelons)	
General	Use a crop rotation of 3-4 years. Grow resistant varieties whenever possible.
Seed rot, damping-off, seed-borne diseases	Plant only certified, western-grown seed treated with captan or thiram. Damping-off can b treated with a captan drench.
Bacterial wilt	Provide season-long control of striped and spotted cucumber beetles. Start as the plants emerg
Anthracnose, scab, blossom blights, gummy stem blight, or black rot	Grow resistant varieties whenever possible. Spray weekly with maneb, zineb, Bravo, Dyren Difolatan, or Benlate.
Downy mildew, Alternaria leaf blight	Grow resistant varieties whenever possible. Maintain ample but *not* excessive nitrogen fertilit Apply maneb, zineb, mancozeb, Dyrene, Bravo, or Difolatan on a weekly schedule.
Fruit spots and rots	Maintain fungicide schedule as for anthracnose through the season. Avoid harvest injuries.
Fusarium wilt	Grow resistant varieties.
Angular leaf spot	Apply fixed copper sprays in combination with zineb, maneb, or mancozeb. Start applicatior early in the season. Practice crop rotations of 3-4 years. Resistant cucumber varieties ar available.
Powdery mildew	Apply Karathane WD at the first sign of disease and again 10 days later. Where Benlate o Bravo are applied to control other diseases, mildew will be controlled well. Plant resistan varieties where possible.
Mosaics	Control aphids and beetles in the field. Control broadleaf weeds around field borders. Plan only mosaic-resistant cucumbers.
Root-knot nematode	Fumigate with Vapam or Vorlex in the fall before planting.
Eggplant	
Seed rot, damping-off, seed-borne diseases	Plant hot water-treated seed when possible. Treat the seed with captan or thiram. Damping-of can be controlled with a captan drench.
Phomopsis blight, Alternaria leaf spot, Cercospora leaf spot, and anthracnose	Spray plants weekly with maneb, zineb, or captan at first sign of disease or when first fruits ar half sized.
Verticillium wilt, nematodes	Fumigate the soil with Vapam, Vorlex, or methyl bromide plus chloropicrin.
Horseradish	
Leaf spots	Apply fixed-copper fungicides. Start when conditions are wet or dews are heavy. Continue until a killing frost occurs.
Brittleroot	Plant clean sets. Control leafhoppers.
Verticillium wilt	Fumigate the soil before planting with Telone C.
Lettuce, Endive	
Seed rot, damping-off, Gray mold	Treat seed with captan. In the field or seed bed, work Botran into the soil before planting and spray Botran after thinning or transplanting and again as necessary. Ferbam or zineb can be used as drenches to control damping-off.
Aster yellows	Control leafhoppers throughout the season. Early season control is most important.
Rhizoctonia bottom rot, Sclerotinia drop	Plant on beds and deep plow when possible. Botran applications as previously described may help.
Gray mold, white rust, downy mildew	Apply ferbam, maneb, or zineb at 5- to 7-day intervals.
Okra	
Seed rot, damping-off	Treat seed with captan or thiram.
Fusarium wilt or Verticillium wilt	Fumigate soil with Vorlex, Vapam, or methyl bromide plus chloropicrin.
Onions, garlic, leek, chives	
Smut, seed rot, damping-off	Treat the seed with captan or thiram. Use Methocel sticker to pellet the fungicide with seed. Use 1 pound of active ingredient to 20 pounds of seed for set onions; 6 pounds of active ingredient to 8 pounds of seed for bulb onions.

Vegetable	Disease management practices
ist, downy mildew, Alternaria ourple blotch, Botrytis neck rot	Apply maneb, zineb, mancozeb, Difolatan, Dyrene, or Bravo on a weekly schedule. Begin spraying with first ozone alert. Continue until harvest. Bravo has given superior control in research trials.
lb and stem nematode, Root-knot nematode	Fumigate with Telone or DD.
sarium basal rot	Avoid heavily infested fields. Grow resistant varieties.
orage decays	Maintain excellent control of leaf diseases in the field. Maintain dry storage conditions.
llow dwarf mosaic	Control aphids. Keep old and new plantings as far apart as possible.
Pe	
edpiece decay, seed-borne seed-borne diseases	Plant western-grown seed treated with captan, thiram, fenaminosulf, or zineb plus insecticide. Graphite at 1 ounce per bushel may be added to reduce friction in the drill.
oot rot	Index production fields. Avoid planting in fields with an index of 75 or higher. In fields with a lower root rot index, dinoseb (Premerge 3) or trifluralin applied preplant incorporated will provide good to excellent control.
isarium wilt, near wilt, and virus diseases	Grow resistant varieties.
owdery mildew	Apply lime-sulfur dust (4:6 ratio) at 30 pounds per acre when mildew first appears and temperatures are less than 80° F. Two applications a week apart will provide good control.
ungal leaf spots and blights	Apply zineb weekly when necessary.
epers	
eed rot, damping-off, and seed-borne diseases	Treat seed with hot water, then use captan or thiram.
acterial spot	Use crop rotations of 2-3 years, excluding small grains and tomatoes. Control broadleaf weeds in field borders. Apply copper plus streptomycin to seedlings. After transplanting, apply fixed copper plus maneb, on a 5- to 7-day interval. Purchase only certified, disease-free transplants.
nthracnose, Cercospora leaf spot, other fungal leaf spots, and fruit rots	Apply maneb or zineb after first fruits form on a 5- to 7-day interval.
erticillium wilt	Fumigate soil with Vapam, Vorlex, or methyl bromide plus chloropicrin.
irus diseases	Grow resistant varieties. Control aphids and broadleaf weeds in and around fields. Plant only healthy transplants.
atoes (Irish)	
eneral	Purchase only certified seed. Seed-production fields should be inspected for virus, nematode, or fungal disease problems.
eedpiece decay, seed-borne Verticillium wilt, and Blackleg	Treat seed with captan, maneb, or mancozeb. Keep seed storage at approximately 40° F. during the winter. In the spring, warm the seed to 60°-70° F. for 1.5-2 weeks before cutting. Streptomycin may be added to fungicide dusts to improve the control of bacterial diseases.
cab	Plant resistant varieties. Do *not* apply manure or other organic matter immediately before the potato crop. Working PCNB into the top 4-6 inches of the soil at or before planting may help.
torage rots	Store healthy, sound, unbruised potatoes. Maintain a proper storage environment. Apply Mertect 340F as a spray to unwashed tubers before storage. This will help control Fusarium dry rot.
hizoctonia	Use a Terraclor EC soil treatment.
Verticillium wilt	Practice crop rotation, use only seed free of Verticillium. Control root-knot and root-lesion nematodes. Soil fumigation with Vapam or Vorlex may be practical.
Nematodes	Where soil samples indicate damaging levels of nematodes, apply Temik or fumigate with Vapam, Vorlex, D-D, or Telone C.
Early blight and late blight	Apply maneb, mancozeb, Difolatan, Bravo, Polyram, Du-Ter, or Dyrene on 7- to 10-day schedule. Mainain an adequate supply of nitrogen throughout the season to provide good control of early blight.
Virus diseases and Purple-top wilt (Aster yellows)	Plant certified seed only. Control aphids and leafhoppers with insecticides.
ubarb (greenhouse only)	
Botrytis leaf rot	Apply after budding and at weekly intervals until harvest.
Crown and root rots	Plant only in well-drained soil. Maintain optimal soil fertility. Drench the crowns with fixed copper at 3 pounds per acre in the early spring and after harvest if crown rot is a problem.
inach	
Seed rot and damping-off	Treat seed with captan or thiram.
Downy mildew or blue mold, White rust, anthracnose, and other fungal leaf diseases	Grow resistant varieties or spray with captan, maneb, or zineb on a 5- to 7-day schedule starting before the plants begin to rosette.
Cucumber mosaic virus or blight	Grow resistant varieties.
eet potatoes	
Black rot, foot rot, Fusarium wilt and scurf	Grow resistant varieties. Plant disease-free roots and use crop rotations of 3-4 years. Dip the roots or sprouts in Botran or Mertect 340F.

Vegetable	Disease management practices
Storage rots	Fumigate storage crates and houses with formaldehyde. Use Botran as a postharvest dip. Sto only healthy, blemish-free roots.
Nematodes	Plant resistant varieties. Use crop rotation. Temik, Mocap, or Dasanit may be used for chemic control.
Tomatoes (field)	
Seed decay, damping-off, and seed-borne diseases	Plant hot water- or copper-treated seed that has been treated with captan or thiram.
Bacterial spot and bacterial speck	Purchase certified, disease-free plants. Use crop rotations of 2-3 years, excluding small grair In the seed bed, spray with fixed copper plus streptomycin. After transplanting, spray with fix copper plus mancozeb. Once established, control of these diseases is difficult.
Septoria blight, early blight, buckeye rot, gray leaf spot, and leaf mold	Apply maneb, mancozeb, Polyram, zineb, Dyrene, Bravo, or Difolatan on a 7- to 10-da schedule after the first sign of disease or after the first fruits form. Difolatan may be used only o machine-harvested fruit. A soil surface spray of Difolatan or maneb after the last cultivatic will improve anthracnose control. Benlate may be used for Botrytis control.
Blossom-end rot	Mulch plants or maintain uniform soil moisture. Applications of calcium nitrate starting whe the fruits are grape size may reduce losses.
Verticillium wilt and Fusarium wilt	Grow resistant varieties.
Viruses	Take care to avoid infecting the seedlings. Start with virus-free seed. Control insects and broac leaf weeds in and around fields.
Tomatoes (greenhouse)	
Virus diseases	Start with hot water-treated seed. Do not allow the use of tobacco on the premises. Smoker should wash their hands with soap and hot water before working with plants. If possible, plar TMV-resistant hybrids. Control insects. Remove infected plants if possible.
Botrytis gray mold, leaf mold, and gray leaf spot	Avoid excessive humidity by heating and venting, especially at night during the late fall, earl winter, and early spring. Spray weekly with Benlate, mancozeb, or Bravo *or* fumigate wit Exotherm Termil.
Nematodes, root rots, and soil-borne TMV	Steam the plant beds.

GENERAL SUGGESTIONS ON FUNGICIDE APPLICATION

1. Cover the foliage uniformly. *Ground equipment* — Apply 75 to 125 gallons per acre at approximately 400 pound per square inch of pressure. Lowering volumes and/or pressures may provide adequate coverage, but high-volume, high pressure applications provide ideal coverage. Make sure the sprayer is functioning properly. Check the nozzles for cleanliness and wear. Boom, height, accuracy of pressure gauge, agitation, and calibration should also be checked. *Aerial application* — Apply recommended amounts of pesticide per acre in 3 to 5 gallons of water. Make sure nozzles are properly alignec and clean, so uniform application is achieved. Cover a swath no wider than is reasonable for the aircraft and boom being used. Spray only those fields which are suitable for aerial application. Avoid fields of irregular shape or topography, particularly if they are bounded by power lines, trees, or other obstructions.
2. Whenever possible spray when the air is still or when wind velocity is not excessive (less than 10 to 12 mph).
3. Avoid situations where pesticide drift may cause needless problems.
4. When it is compatible with the product label, use a spray adjuvant (surfactant). Some commonly available surfactants are: Colloidal Products X77 (liquid, non-ionic) spreader activator; Colloidal Products Multifilm L. (liquid); Colloidal Products Spray Modifier (liquid, non-ionic) spreader sticker; Millers Nufilm 17 liquid spreader sticker; Millers Nufilm P liquid spreader sticker; Allied Chemical Plyac (liquid) sticker; Rohm and Haas Triton B — 1956 (liquid, non-ionic) spreader sticker; Triton CS7, spreader-binder; and Du Pont Spreader Sticker (liquid) spreader sticker.

GENERAL SUGGESTIONS ON SOIL FUMIGATION

Follow the manufacturer's directions exactly. Fumigants work best in light, loose soils that are free of trash, clods, and lumps. Avoid recontaminating treated soil. It is best to apply fumigants during the fall before planting. In general, the soil temperature must be at least 55° F. at the 6-inch depth, with a time lapse of 21-28 days between treating and seeding. Some require gas-tight plastic covers.

RECORD SHEET FOR FUNGICIDE USERS

Date	Vegetable	Chemical	Dosage per acre	Remarks

Herbicide Guide 1981
FOR COMMERCIAL VEGETABLE GROWERS

Restricted-use herbicides are identified with an asterisk (*).
You must be certified as a pesticide applicator to use restricted-use pesticides.
See your county Extension adviser in agriculture for information.

WEED GROWTH reduces the income of vegetable growers in the United States by millions of dollars annually as a result of lower yields, poorer quality, and added labor in harvesting and processing.

This guide should be used together with the grower's knowledge of soil types and the crop and weed history of the area to be treated. Whether to use herbicides or other means of weed control depends in part on the severity of past weed infestations. In many instances mechanical control is sufficient, or it may be needed in addition to herbicide use. Several herbicides may be suggested for some crops. These herbicides have shown good control with no injury to the vegetables under test conditions. Not all herbicides cleared for use on a species are necessarily listed. Where the choice of more than one herbicide is suggested, the decision rests with the grower and is based on his knowledge of past weed infestations, crop rotations, and material costs. Where one herbicide will not control the weeds present, a combination of herbicides may be suggested. When using a herbicide for the first time, it is advisable to use a small-scale trial.

These suggestions for chemical weed control in vegetables are based on research at the Illinois Agricultural Experiment Station, the U.S. Department of Agriculture, and other research institutions. The University of Illinois and its agents assume no responsibility for results from the use of these herbicides, whether or not they were used in accordance with suggestions, recommendations, or directions of the manufacturer or any governmental agency.

Reading the label of the herbicide container is the most profitable time you spend in weed control. Use of the material and methods of application and use depend on registration of the herbicide by federal and state Environmental Protection Agencies (EPA). Do not use any herbicide *unless the label states that it is cleared for the use on the crop to be treated.*

Herbicides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. A person wishing to use a herbicide classified for restricted use must be certified as a private or commercial pesticide applicator by the Illinois Department of Agriculture. Contact your county Extension adviser in agriculture for details about this program.

Only a few herbicides have been classified at this time. More will be classified later.

When applying mixtures of chemicals, the *user* assumes responsibility for freedom from residues if the mixture is not labeled by the EPA.

Suggestions sometimes change during the growing season, based on EPA clearances that were made after this circular was issued. This publication, printed once a year, is subject to change without notification.

Watch for notice of changes in the EPA registration of herbicides (as released by the EPA) in the *Illinois Vegetable Farmer's Letter* and the *Insect, Weed, and Plant Disease Survey Bulletin.* Subscription forms for these University of Illinois newsletters are available from the Agricultural Newsletter Service, 116 Mumford Hall, Urbana, Illinois 61801, or your county Cooperative Extension Office.

NOTE: In the suggestions on the following pages, trade names of herbicides are usually used. The list below shows trade names and their corresponding common names. **Restricted-use herbicides are identified with an asterisk(*).**

Common name	Trade name	Common name	Trade name	Common name	Trade name
alachlor	Lasso	dalapon	Basfapon, Dowpon	naptalam	Alanap
atrazine	AAtrex and others	DCPA	Dacthal	nitrofen*	TOK*
benefin	Balan	dinitramine	Cobex	paraquat*	Paraquat*
bensulide	Prefar	dinoseb	Premerge-3, Sinox	phenmedipham	Betanal
bentazon	Basagran	diphenamid	Dymid, Enide	profluralin	Tolban
butylate	Sutan+	diuron	Karmex	pronamide*	Kerb*
CDAA	Randox	EPTC	Eptam, Eradicane	propachlor	Bexton, Ramrod
chloramben	Amiben, Vegiben 2E	glyphosate	Roundup	pyrazon	Pyramin
chlorbromuron	Maloran	linuron	Lorox	simazine	Princep
chlorpropham	Furloe	MCPA, MCPB	(numerous ones)	trifluralin	Treflan
cyanazine	Bladex	metribuzin	Lexone, Sencor	Petroleum solvent	Stoddard Solvent
cycloate	Ro-Neet	napropamide	Devrinol	2,4-D (amine)	(numerous ones)

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
Prepared by H. J. Hopen, Department of Horticulture (revised annually) CIRCULAR 907 (October 1980)

	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
s)	Amiben	3 lb.	Annuals	Immediately after seeding	Irrigation or rainfall after treatment will give maximum control.
ags lished ng)	dalapon	5-10 lb.	Perennial grass	End of harvest season following disking	Apply when grass weeds are 3 to 4 inches tall. Direct spray under fern growth. Use surfactant as directed on label.
	Karmex	1-4 lb.	Annuals	In spring and/or after harvest	Apply after disking. Do not exceed 6 pounds per growing season. Use a lighter rate on sandy soil. With Karmex and Princep, a spring application may be sufficient after the first year.
	Princep	3-4 lb.	Annuals	In spring and/or after harvest	Apply after disking. Do not treat during the last year in asparagus because of residue.
	metribuzin	1-2 lb.	Primarily broad-leaf weeds	Early spring before the spears emerge	Apply after disking. Do not apply within 14 days of harvest. Can help control broadleaf weeds when used with dalapon, Karmex, or Princep.
	Perennial weed control, applications during and outside the growing season (see page 5)				
	Stale seedbed, before crop emergence (see page 5)				
	Preemergence				
, ry, l snap	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Plant crop immediately, or within 3 weeks after application. Can be used up to 1 pound per acre on dry beans.
	Tolban	0.5-1 lb.	Primarily annual grasses	Preplant soil incorporation	
	Premerge-3	6-7.5 lb.	Annuals	Can be used between planting and crop emergence	Do not use on light, sandy soil. Some stand reduction may result from use. See label for precautions.
	Postemergence				
	Basagran	0.75-1 lb.	Annual broad-leaf weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after the first trifoliate leaf appears on beans	Can provide good, broad-spectrum control when combined with a grass-active herbicide. Do not mix with other pesticides. See Basagran entry under corn, postemergence for Canada thistle and nutgrass control.
	Perennial grass control, applications outside the growing season (see page 6)				
ma	Amiben	2-3 lb.	Broad spectrum of annual weeds	Immediately after seeding, or preplant-incorporated for lima beans	Field may be rotary-hoed without destroying herbicide action.
nap	Eptam	3 lb.	Annual grasses and nutgrass[3]	Preplant soil application, incorporate with soil immediately	
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	Do not feed treated plant parts to livestock.
	Vegiben 2E (2E form *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	Use on loam soil.
lry	Cobex	0.3-0.6 lb.	Annuals	Preplant soil incorporation	
arden	Pyramin	4 lb.	Annuals (primarily broadleaved)	Preemergence or after beets emerge and before weeds have two true leaves	Rainfall or irrigation needed to activate. Where grasses are a severe problem, use 4 pounds of Pyramin plus 4 pounds of Ro-Neet.
	Ro-Neet	4 lb.	Annual grasses	Preplant soil application, incorporate with soil immediately	Use a combination treatment with Pyramin to broaden control spectrum.
	Betanal	1-1.5 lb.	Broad spectrum of annual weeds. Not effective on pig-weeds	After the beets are past the 2-true-leaf stage	Beets in the cotyledonary stage may be severely injured. For best results, spray when the weeds are between the cotyledonary and 2-true-leaf stage. Best results will be obtained when the weeds are actively growing and are not under water or heat stress. Do not apply later than 50 days before harvest. May injure beets under heat, water, or other environmental stress.
	Preemergence — direct-seeded or transplanted				
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Stunting or growth reduction may occur at recommended rates under growth stress conditions. Can be used up to 1 pound per acre on transplants.
e wer	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding. Can also be incorporated preplant	
	Postemergence — direct-seeded or transplanted				
	TOK[6]*	3-6 lb.	Broadleaved weeds[6]	One to two weeks after emergence or transplanting, while weeds are in seedling stage	Use wettable-powder formulation to reduce injury potential. Use in combination with preplant or preemergence material for annual grass control.
	TOK may not be available for the 1981 season because of possible label cancellation. Watch the University of Illinois vegetable and pest control newsletters (see page 1) for news concerning the status of TOK.				
	Preemergence				
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Seed after application to 3 weeks later.
	Postemergence				
	Lorox	0.75-1.5 lb.	Annuals	Postemergence on carrots only after the crop is 3 inches tall; grasses, less than 2 inches; broadleaves, less than 6 inches	Do not feed treated foliage to livestock or replant treated area for 4 months. More than one application may be made, but do not exceed a total of 2 pounds per acre. Do not use over 40 PSI. Use no surfactants when temperatures exceed 80°F., or crop injury may result.
	TOK*	3-6 lb.	Broadleaved weeds[6]	While weeds are in the seedling stage	Can also be used on celery and parsley. Combine with preplant or preemergence material for annual grass control.
	TOK may not be available for the 1981 season because of possible label cancellation. Watch the University of Illinois vegetable and pest control newsletters (see page 1) for news concerning the status of TOK.				

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notes on page 6.)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Carrots (cont.)	Stoddard Solvent	60-80 gal.	Annuals	After two true leaves have appeared (do not apply to carrots or parsnips after they are ¼ inch in diameter, since an oily taste may result)	Most effective when sprayed on cloudy days or duri humidity, and when weeds are not more than 2 inch May not control ragweed. Do not apply within 40 harvest. Can be used on celery, dill, parsnips, and
Corn, pop	**Preemergence**				
	atrazine	2-3 lb.	(See sweet corn)	(See sweet corn)	See sweet corn, *except the section on preemergence combi*
	Bladex	(See remarks)	Annuals	Preemergence only	Some pop corn varieties are sensitive to the app rate. (See remarks on Bladex under sweet corn.)
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	See sweet corn.
	Lasso	2-2.5 lb.	Annuals	Preemergence	See sweet corn.
	Princep	2-3 lb.	Annuals	Preemergence	Plant only crops so specified on the label the followi Do not graze treated areas.
	Sutan +	3-4 lb.	Primarily annual grasses	Preplant soil application, incorporate with soil	See sweet corn.
	Postemergence				
	2,4-D	0.5 lb.	Broadleaved weeds	Postemergence	Apply when corn is 3 to 10 inches tall.
	Perennial grass control, applications outside the growing season (see page 6)				
Corn, sweet	**Preemergence**				
	atrazine	2-3 lb.	Annuals, annual and perennial grasses[7]	Preemergence, apply no later than 3 weeks after seeding. Shallow cultivation may improve weed control during dry weather.	Grow corn a second year without atrazine treatmen chemical has a high soil residue. Do not plant othe table crops on a sprayed area until a second year of c been grown. Use atrazine where quackgrass is a pr Residue hazard decreased when banded or in combi with Lasso, propachlor, or Sutan.
	Bladex	(See remarks)	Annuals	Preemergence only	Some sweet corn varieties are sensitive to the appl rate. Has been shown to have less soil residual than at See label for rates and precautions. Do not use pos gence, or on sandy or loamy-sandy soils (under 1 p organic matter). Can be combined with other herbic reduce the rate being used. NOTE: The Shell Ch Co. has a bulletin on using Bladex on pop and sweet
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	Use to control weeds that are difficult to control wit herbicides, such as wild cane, nutsedge, quackgras Proso millet, and seedling Johnsongrass.
	Lasso	2-2.5 lb.	Annuals	Preemergence	Preplant incorporation may aid control of nutgrass.
	propachlor	4-5 lb.	Annuals	Preemergence	Do *not* use on sandy soils. Is an excellent herbicide o with a high organic-matter content.
	Sutan +	3-4 lb.	Primarily annual grasses	Preplant soil application, incorporate with soil	Especially useful on sandy soil and where nutgras problem.
	Preemergence combinations				
	atrazine plus Lasso	1.5 lb. +2 lb.	Annuals and perennial grasses	Preemergence or preplant incorporated	See label for slightly higher rate of Lasso for prepla corporation.
	atrazine plus propachlor	1.5 lb. +3 lb.	Annuals and perennial grasses	Preemergence	Use to reduce atrazine residue.
	atrazine plus Sutan +	1 lb. +3-4 lb.	Annuals and perennial grasses	Preplant soil incorporation, incorporate with soil immediately	Use where nutgrass is a problem and to reduce at residue.
	Postemergence				
	2,4-D (amine)	0.5 lb.	Broadleaved weeds	Postemergence	Preferably, apply before corn is 6 inches tall. If corn i 12 inches, reduce the rate to ¼ pound.
	atrazine	2 lb.	Annuals, annual and perennial grasses[7]	Directed spray 3 weeks after emergence	Can be combined with crop oils for postemergence ap tion as an emergency measure. This may increase resid following year. Preemergence use preferred. Do not or feed treated foliage for 21 days after treatment.
	Basagran	0.75-1 lb.	Broadleaved annual weeds, Canada thistle, and nutsedge	Early postemergence when the weeds are small and actively growing. Delay will result in less control.	For Canada thistle and nutsedge, split application preferred. Make the first one when the plants are 6 inches tall; for nutsedge, 7 to 10 days later; for Ca thistle, 10 to 14 days later (or use one application cultivation). Do not mix with other pesticides.
	Perennial grass control, applications outside the growing season (see page 6)				
Cucumbers Muskmelons Watermelons	Alanap[8]	3-5 lb.	Annuals[3]	Immediately after seeding or transplanting	Do not use on cold soil. Rainfall or irrigation after t ment gives maximum control.
		3-3.5 lb.		After transplanting or vining	Use the granular form. Keep away from foliage. Appl soil after the weeds have been removed.
	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Is primarily a grasskiller. Consult label for sensitive within 18 months after application. Prefar can be us rotation with tomatoes, broccoli, cauliflower, let carrots, onions, and summer squash within 18 mont
	Prefar plus Alanap[8]	4 lb. +2-3 lb.	Grasses and broadleaved weeds	Preplant soil incorporation for Prefar; Alanap, as an immediate postseeding application	Has value for broad-spectrum weed control. Consult for sensitive crops within 18 months after Prefar app tion. Has EPA approval as a tank mixture.
	Vegiben 2E (2E form *only*)	1.5-3 lb.	Broad spectrum of annual weeds	Immediately after seeding	This ester form of chloramben may leach less readi sandy soils. Above 1.5 to 2 pounds per acre, injury cha increase under moist soil conditions. Some muskmelon tivars may be susceptible to Vegiben injury.

As an alternative to herbicides where earliness is desired, black polyethylene mulch will control annual weeds, conserve moisture, and incr early spring soil temperatures.

(See footnotes on page 6.)

Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	After plants are established, 4-6 weeks after transplanting	Cultivate and weed prior to application. Can be applied to plants as part of a uniform soil application.
Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	For use on collards, kale, mustard greens, and turnips.
Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	For use on collards, kale, mustard greens, and turnip greens.
Furloe	1-2 lb.	Primarily broadleaved annuals	Preemergence	For spinach only. Use lower rates in cool, wet weather.
Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after transplanting	Use for annual grass control and combine with TOK as an early postemergence treatment for broadleaved weeds.
TOK[5]*	3-6 lb.	Broadleaved weeds[6]	Before weeds are 1 inch high	Will not consistently control weeds over 1 inch tall. Some emerging annual grass may be controlled by this treatment. Lower rate will control seedling purslane.

TOK may not be available for the 1981 season because of possible label cancellation. Watch the University of Illinois vegetable and pest control newsletters (see page 1) for news concerning the status of TOK.

Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Balan	1.5 lb.	Annuals	Preplant soil incorporation Incorporate with soil immediately	Is primarily a grasskiller. Seed after application to 3 weeks later. Do not plant wheat, barley, rye, grass, onions, oats, beets, or spinach for 12 months after application.
Kerb*	1-2 lb.	Annuals	Preemergence or preplant-incorporated	Do not use when the air temperature exceeds 85° F. Use the lower rates listed on sandy soil. Do not use on peat or muck soils. See label for rotation crops. For best results, rainfall or irrigation is needed 1 to 2 days after application, especially during warm weather.
Preemergence				
Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding or transplanting	May not kill smartweed or common ragweed. Can be used on seeds, sets, or seedlings. Use only on mineral soils. Use lower rates on sandy soils. A double application of Dacthal can be used at seeding, layby, or both. In most situations, the weed spectrum on mineral soils will respond well to a combination of Dacthal preemergence and TOK postemergence.
Randox	4-6 lb.	Annuals[9] (primarily grasses)	Just before onions emerge	Use on muck soils. Heavy rainfall may reduce stand. Very effective on purslane and pigweed.
Postemergence				
TOK*	3-4 lb.	Broadleaved weeds	When weeds are in the seedling stage and not over 1 inch high	Use a single application of E.C. or W.P. per growing season. Do not apply E.C. until onions are in the two- to three-leaf stage. *Preemergence* use of TOK with heavy rainfall may reduce stand. Use in combination with preplant or preemergence material for annual grass control.

TOK may not be available for the 1981 season because of possible label cancellation. Watch the University of Illinois vegetable and pest control newsletters (see page 1) for news concerning the status of TOK.

Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Furloe	3-6 lb.	Broadleaved weeds (especially smartweed)	On seeded onions: loop stage or after 3- to 4-leaf stage	In the later sprays, direct at base of onion plant. If more than one application is applied do not exceed 6 pounds per acre for the season. *Use lower rates in cool, wet weather.* Use no later than 30 days before harvest.
Preemergence				
propachlor	4-4.9 lb.	Annuals	Preemergence	Do *not* use on sandy soil.
Treflan	0.5-0.75 lb.	Annuals[2]	Preplant soil incorporation, incorporate with soil immediately	Seed after application to 3 weeks later. Some reduction of growth and stand reduction possible under stress. May suppress some root rot.
Cobex	0.3-0.5 lb.	Annuals	Preplant soil incorporation	
Preemergence or Postemergence				
Premerge-3	0.3-9 lb.	Annuals (primarily broadleaved weeds)	Preemergence or postemergence	Preemergence use 6 to 9 pounds; postemergence, use 0.3 pound to 1.1 pounds. Apply prior to bloom when peas are 2 to 8 inches tall. See label for further precautions. Preemergence use may help suppress root rot.
Postemergence				
Basagran	0.75-1 lb.	Annual broadleaf weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after peas have 3 pairs of leaves (or 4 nodes)	Can help control Canada thistle. Can provide good, broad-spectrum control when used with a grass-active herbicide. Do not mix with other pesticides. See Basagran entry under corn, postemergence for Canada thistle and nutgrass control.
MCPB	1 lb.	Broadleaved weeds and Canada thistle	When peas are 3-7 inches tall and no later than 4 nodes prior to pea blossom	May delay maturity 1 to 4 days. Use at least 20 gallons of water per acre. Do not feed vines to livestock.
MCPA	0.25-0.5 lb.			MCPA is more effective on mustard. MCPB is less injurious to peas.
Perennial grass control, applications outside the growing season (see page 6)				
Eptam	3-6 lb.	Annual grasses and nutgrass[3]	Drag-off treatment at emergence or preplant soil application Incorporate with soil immediately	Use lower rate on sandy soil.
Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Drag-off treatment at emergence	Use a light incorporation.

on page 6.)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Potatoes, Irish (cont.)	Lorox	0.75-2 lb.	Annuals	Apply prior to potato emergence	Plant tubers at least 2 inches deep. Do not plant tr area to other crops for 4 months after treatment. M jure crop on light, sandy soil. Do not apply over ex tubers.
	chlorbromuron	2-3 lb.	Annuals	At very start of potato emergence	May injure crop on light, sandy soil. Do n harve mature potatoes. Do not plant crops other t n field potatoes, or soybeans for 6 months after ap ying.
	dalapon	7 lb.	Quackgrass	Before plowing in spring; wait 4 days before plowing and planting	Not for fields intended for red-skinned vari es or Rose. Do not plant potatoes for 4 weeks. U surfa as directed on label.
	metribuzin	0.25-0.5 lb.	Annuals (primarily broadleaved)	Postemergence, following a preemergence grass herbicide	Can be used preemergence also. Do not excee acre in a season. Do not apply within 60 da Do not use on red-skinned or early matur rieties. Do not apply in cool, wet weather.
	Lasso	2.5-3 lb.	Annuals	Apply at drag-off	Do not use on sandy soils. Can be used alone tion with Lorox or dinoseb.
Potatoes, sweet	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after planting	
	Amiben	3 lb.	Annuals	Immediately after planting	
	Dymid, Enide	4-6 lb.	Annuals	Immediately after transplanting	Do not plant nonapproved crops on treated s same season.
Squash Pumpkins	Amiben	3-4 lb.	Annuals	As soon after seeding as possible, or preplant-incorporated	Use on loam soils. Amiben can be applied banded over the row in pumpkins.
Squash	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Is primarily a grasskiller. Consult label for se within 18 months after application. Prefar ca rotation only with tomatoes, broccoli, caulifl carrots, onions, and summer squash within application. Use in combination with Alanap as suggested fo
Tomatoes, direct-seeded and transplanted	Dymid, Enide	4-6 lb.	Annuals	Preemergence	Do not plant other food crops on treated areas If used under dry soil conditions, a shallow in corporation as a preplant treatment may im ove control. Can also be used on transplanted pep s.
	Devrinol	1-2 lb.	Annuals	Preplant soil incorporated	Can also be used on direct-seeded and transplan d pepp
	metribuzin	0.25-1 lb. (min.-max.)	Primarily broadleaf. Should be used with a grass-active herbicide.	Preplant incorporated. Postemergence, can be broadcast or directed.	Apply with ground equipment to seeded and t tomatoes. Do not use air-blast or other high-pr equipment. Do not use on peppers.
		0.25-0.5 lb.		Preplant incorporated, transplant tomatoes	Alone or in a tank-mix combination with Trefl
		0.25-0.5 lb.		Broadcast spray, established tomatoes	Single or multiple applications. Minimum 14 between treatments. Direct-seeded plants shou have 6 leaves; transplants should show new growth.
		0.5-1 lb.		Directed spray, established tomatoes	Recommended for use in fields with severe wee probl or for fields with hard-to-control weeds.
		(For min.-max. rates)			Do not apply within 7 days of harvest. Do not a ly wi 3 days following periods of cool, wet, or clou weat otherwise, crop injury may occur. Do not app to es lished tomatoes within 24 hours after the ap catio other pesticides. Do not tank-mix with other estic except Treflan. Do not apply more than 1 pou per per crop season, or more than 1 pound per ac with 35-day period. Allow at least 14 days between a licati regardless of the dosage or method used. Do use caps on tomatoes within 7 days before applic on, o any time afterward.
Tomatoes and Peppers, transplanted	Amiben	3-4 lb.	Annuals	Wait 3 days after transplanting to apply	Use granular formulation only. Apply to dry folia to avoid leaf burn. Do not use on sandy soils.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Some reduction of growth may be possible un gro stress conditions, or if rates are higher than su sted the soil type.
	Stale seedbed, before crop emergence				
Asparagus	Paraquat*	0.5-1 lb.	All emerged green foliage	Before crop emergence; allow maximum weed emergence prior to treatment	Weeds that emerge after treatment will not be ntrol Crop plants that have emerged at application l be jured. Do not apply within 18 months of harves
	Perennial weed control, applications during and outside the growing season				
Asparagus	Roundup	2-5 lb	(See remarks)	Before emergence, or with shielded or directed sprays during fern growth	Use to control milkweed, thistle, field bindwee qua grass, or Johnsongrass. Apply to quackgrass when is 6- tall in the fall or spring. Apply to Johnsongrass w it least 12 in. tall and actively growing. Do not t for specified time for each species (see label). Does n pro residual weed control. Do not mix, store, or apply spray solutions in containers or spray tanks ma of vanized or unlined steel (except stainless steel).

(See footnotes on page 6.)

Treatment	*Active ingredient per acre actually covered*[1]	*Weeds controlled*	*Timing of application (based on crop stage)*	*Remarks, cautions, limitations*
Perennial grass control, applications outside the growing season				
Roundup	2-3 lb.	(See remarks)	(See remarks)	Use for quackgrass or Johnsongrass control. Apply to quackgrass when 6 to 8 inches tall in fall or spring. Apply to Johnsongrass when at least 12 inches tall and actively growing. Do not till until 3 to 7 days after application. Does not provide residual weed control. Do not mix, store, or apply Roundup spray solutions in galvanized steel or unlined steel containers (except stainless steel) or spray tanks.

ried-use herbicides are identified with an asterisk(*).
d active ingredients (actual amount of active herbicide in material or acid equivalent). Use lower rate on sandy soil and higher rate on clay and loam soils. When bd application over the row, adjust amount of material applied to the part of an acre treated. See Illinois Circular 1047. [3] May not control ragweed and panicum. ontrol smartweed. [4] May not control ragweed, smartweed, and velvetleaf. [5] Use of 50% wettable powder is suggested for cabbage and horseradish. [6] May not control chickweed. Grass control is sometimes marginal. [7] May not control crabgrass. [8] Do *not* use Alanap Plus, Solo, Whistle, or Amoco Soybean herbicide. These materials Alanap plus another ingredient that may cause injury. [9] May not control smartweed and velvetleaf.

Storing Pesticides and Containers

p pesticides and containers in a separate building, room, or enclosure used only for this purpose. Such buildings or rooms e dry, ventilated, and locked. Fence outside storage areas to protect children and animals and to discourage pilferage. CAU- Do not store weedkillers, herbicides, or defoliants in the same room with insecticides. Chlorate salts can create a fire or n hazard. Remove only the pesticides needed for one day's operation and return empty containers — and any unused pesti- the storage area each day.

Disposing of Pesticides and Containers

plus Pesticides. To dispose of surplus pesticide mixtures, try to find other areas with the same pest problem and use up a tank mix or rinse water on these areas. Do not drain surplus pesticides in any location where they can contaminate wells, rivers, lakes, or ponds.

erators of landfills meeting environmental safety standards can obtain supplemental permits to handle toxic waste materials, in- pesticides. To dispose of large quantities of surplus pesticides, contact the Illinois EPA Division of Land Pollution Control the nearest landfill with a supplemental permit for toxic waste or to obtain specific instructions about disposal.

sticide Containers. All empty pesticide containers, regardless of their type, should be rinsed three times before disposal. ater should be dumped in the tank. Triple-rinsed containers should be punctured or broken to facilitate drainage and to pre- se for any purpose. They should then be hauled to a sanitary landfill for disposal. Small quantities of containers may be buried open fields, with due regard for the protection of surface and subsurface water.

nois regulations permit the burning of combustible containers provided that they are burned on the premises where they were at they are burned more than 1,000 feet from residential areas, that the burning will not cause undue visibility or environmental , and that no reasonable alternate disposal method is available.

not breathe smoke from burning pesticide containers, and do not burn containers that have weedkillers such as 2,4-D or similar es. When these change to a gas, the vapors may damage nearby crops and shrubbery. Pesticides containing chlorates may ex- hen heated and, therefore, should not be burned.

Other Publications on Weed Control

ies of the following publications on weed control are available from the office of your county Extension adviser in agriculture riting to the Office of Agricultural Publications, 123 Mumford Hall, Urbana, Illinois 61801.

- Prevent 2,4-D Injury to Crops and Ornamental Plants — Circular 808
- Legal Aspects of Crop Spraying — Circular 990
- Calibrating and Adjusting Granular Row Applicators — Circular 1008
- Calibrating and Maintaining Spray Equipment — Circular 1038
- Controlling Weeds in the Home Garden — Circular 1051
- Turfgrass Pest Control — Circular 1076
- Herbicides for Commercial Fruit Crops in Illinois — H-659
- Herbicide Recommendations for Commercial Nurserymen — NC-2-80
- 1981 Field Crops Weed Control Guide

Horticulture Facts

Publications About Vegetable Crop Production

VC-12-8

J.M. Gerber, H.J. Hopen, and J.W. Courter
Department of Horticulture

The following list is of publications pertinent to vegetable crop production that can be obtained from the University of Illinois. They will be of interest primarily to commercial vegetable growers, although home gardeners will also find some of them useful.

UNIVERSITY OF ILLINOIS CIRCULARS AND BULLETINS

Single copies of many of the following publications are available free from county Extension Offices, or from the Office of Agricultural Publications, 123 Mumford Hall, Urbana, IL 61801. Please note the single-copy charge for some items. Quantity discounts are available on C-718 and C-1150.

No.	Title
C-718	Weeds of the North Central states ($1.50)
C-808	Prevent 2,4-D injury to crops and ornamental plants
C-827	Controlling Johnsongrass in Illinois
C-828	Controlling giant foxtail in Illinois
C-850	Controlling poison ivy
C-879	Home greenhouses for year-round gardening pleasure
C-884	Growing vegetable transplants
C-897	Insecticide recommendations for vegetable crops
C-907	Herbicide guide for commercial vegetable growers
C-981	Growing tomatoes at home
C-990	Legal aspects of crop spraying
C-999	Fungicide guide for commercial vegetable growers
C-1008	Calibrating and adjusting granular row applicators
C-1038	Calibrating and maintaining spray equipment
C-1084	Illinois horseradish: a natural condiment
C-1138	Pesticides and honey bees
C-1139	Agricultural labor laws in Illinois
C-1150	Vegetable gardening for Illinois ($2)
C-1156	Soil productivity in Illinois
C-1174	Vegetable varieties for commercial market growers
B-725	Soils of Illinois
B-735	Soil type acreages in Illinois ($1)
B-749	Seeding rates, cultivars, and planting methods for small processing onions

HORTICULTURE FACTS (VEGETABLE SERIES)

Single copies are available free of charge from 101 Vegetable Crops Building, University of Illinois, Urbana, IL 61801. However, there is a charge for quantity orders. For price quotations, contact the Department of Horticulture, 124 Mumford Hall, Urbana, IL 61801.

No.	Title
VC-1-80R	Commercial vegetable varieties for plant growers
VC-2-79	Garden values for vegetables and small fruits
VC-3-79	Storing home-grown onions
VC-4-79	Inhibiting sprouts in onions in potatoes that are to be stored
VC-5-80	Organic gardening and soil fertility
VC-6-80	Making compost for the garden
VC-7-80	Fertilizer guide for market gardeners
VC-8-80	Fertilizer conversion tables
VC-9-80	Fertilizing your vegetable garden
VC-10-80	Sources of vegetable seeds

HORTICULTURE FACTS (HORTICULTURE MARKETING SERIES)

No.	Title
HM-1-79	Pick-your-own marketing of fruits and vegetables
HM-2-79	Liability and insurance for U-pick operations
HM-3-79	Net weights and processed yields of fruits and vegetables in common retail units
HM-4-80	Establishing a community farmers' market

USDA PUBLICATIONS

Single copies of the following publications from the U.S. Department of Agriculture are ailable free of charge from 101 Vegetable ops Building, Urbana, IL 61801. Send re- iests for larger quantities to: Superinten- nt of Documents, U.S. Government Printing fice, Washington, D.C. 20402.

.	Title
-212	Mint farming
-380	Insects and diseases of vegetables in the home garden
S-8-9-1	Starting plants from seeds
S-8-13-1	Vegetable harvest and storage
-203	Tomato diseases and their control
-221	Lettuce production in the U.S.
-382	Commercial production of greenhouse tomatoes
-388	Sweet potato culture and diseases
-474	Potato diseases
-507	Usual planting and harvesting dates for fresh market and processing vegetables
1537	Johnsongrass ... as a weed
2148	Aphids on leafy vegetables
2183	Using phenoxy herbicides effectively
2200	Controlling tomato diseases
2201	Growing ginseng
2232	Commercial growing of asparagus
2233	Commercial growing of watercress
2239	Growing cauliflower and broccoli
180	Growing tomatoes in the home garden
202	Growing vegetables in the home garden
360	Growing table beets
445	Electric heating of hotbeds
509	Muskmelon for the garden
523	Canada thistle and its control
544	Protecting honey bees from pesticides
547	Commercial growing of horseradish
548	Controlling the Mexican bean beetle
555	Rhubarb production
R-637	Hydrocooling vegetables

ANT PATHOLOGY REPORTS

The following publications are available at cents each from the Department of Plant thology, N-533 Turner Hall, Urbana, IL 61801.

.	Title
1	Stewart's leaf blight of corn
3	Common corn smut
0	Controlling diseases in the home vegetable garden
903	Carrot yellows
915	Vegetable seed treatment
916	Damping-off and seedling blights of vegetables
920	Anthracnose of cucumber, muskmelon, and other vine crops
942	Gray-mold rot or Botrytis blight of vegetables
955	Blackleg of cabbage and other Crucifers

ENTOMOLOGY FACTSHEETS

The following factsheets are available from Extension Entomology, 165 Natural Resources Building, Urbana, IL 61801.

No.	Title
21	Armyworms
23	White grub
24	Common stalk borer
25	Grape Colaspis
26	Corn rootworm
27	Corn seed insects
28	Corn blotch leaf miner
29	Corn leaf aphid
30	Some common insect predators and parasites
31	Corn root aphid and corn field ant
32	Japanese beetle
33	Corn earworm
34	Fall armyworm
35	Chinch bug
36	Corn flea beetle
37	Billbugs
38	Black cutworm
39	Thrips on corn
40	Corn sap beetle
41	Miscellaneous corn leaf feeding insects
42	Webworm
43	Wireworm
44	Cabbage maggot on cabbage and related crops
45	Cabbage worm
46	Striped and spotted cucumber beetles
48	Onion thrips
49	Asparagus beetle
50	Onion maggot
51	Squash bugs on melon and vine crops
84	Slugs
90	Check list of insecticides
96	Measurements of small quantity of spray
97	Dilution table for insecticides
120	Corn insects—above ground
125	Common vegetable insects
130	Hornworms

Horticulture Facts

Sources of Vegetable Seeds

VC-10-0

J.M. Gerber, J.W. Courter, and C.M. Sabota
Department of Horticulture

The following is a partial list of seed houses that supply seeds to vegetable growers and home gardeners in Illinois. This list is intended to provide firm names and addresses only. No endorsement is intended or should be implied.

Most firms sell both commercial and home-garden quantities. Others sell only at wholesale [W] or only to commercial growers [C]. Some firms only sell specialty items or nonstandard vegetables [S], as designated by letters in brackets.

ABBOTT AND COBB, INC., Box 307, Feasterville, PA 19047. [C]

ABUNDANT LIFE SEED FOUNDATION, Box 374, Gardiner, WA 98334. [S; heirloom beans, corn tomatoes]

AGWAY, INC., Box 1333, Syracuse, NY 13201.

ALEXANDER, P.O. Box 40031, Nashville, TN 37204. [S; Dominican black beans]

AMERICAN SEEDLESS WATERMELON SEED CORP., Goshen, IN 46526. [S]

APPLEWOOD SEED CO., 833 Parfet St., Lakewood, CO 80215. [S; container vegetables, herbs]

ARCHIAS SEED STORE, 106 E. Main St., Sedalia, MO 65301.

ASGROW SEED CO., P.O. Box 8, Mechanicsburg, PA 17055. [C]

BALL SEED CO., Box 335, West Chicago, IL 60185. [C]

BILL BOATMAN'S NURSERY AND SEED CO., S. Maple St., Bainbridge, OH 45612.

BURGESS PLANT AND SEED CO., P.O. Box 218, Galesburg, MI 49053.

BURPEE SEED CO., 615 N. 2nd St., Clinton, IA 52732.

BURRELL SEED GROWERS CO., 405 N. Main, Rocky Ford, CO 81067.

D.V. BUTTERBROOKE FARM, 78 Barry Rd., Oxford, CT 06483. [S; untreated seed]

A.L. CASTLE, INC., Box 877, Morgan Hill, CA 95037. [C]

COMSTOCK, FERRE AND CO., 263 Main St., Wethersfield, CT 06109.

S.C. DARBONNE, B.P. No. 8, 91490 Milly-la-Foret, France. [S; hybrid asparagus]

DAVID CROCKETT POPCORN CO., Box 237, Metama OH 45340. [S; organically grown popcor

DeGIORGI CO., INC., Council Bluffs, IA 515(

J.A. DEMONCHAUX CO., INC., 827 N. Kansas, Topeka, KS 66608. [S; French specialti]

DESSERT SEED CO., P.O. Box 181, El Centro, CA 92243. [C]

DR. YOO FARM, P.O. Box 290, College Park, M 20740. [S; Chinese vegetables]

EPICURE SEEDS, LTD., Avon, NY 14414.

FARMER SEED AND NURSERY CO., Faribault, MN 5521

FERRY-MORSE SEED CO., Commercial Sales, P.O Box 100, Mountain View, CA 94042. [C]

FERRY-MORSE SEED CO., Home Garden Div., Box 488, Fulton, KY 42041.

GERMANIA SEED CO., 5952 N. Milwaukee Ave., Chicago, IL 60646. [C]

H.G. GERMAN SEEDS, INC., Smethport, PA 16749 [C]

GLECKLER'S SEEDSMAN, Metamora, OH 43540. [S unusual selections]

GOLDSMITH SEEDS, INC., P.O. Box 1349, Gilroy CA 95020.

GRACE'S GARDENS, 39 E. Ave., C, Bayonee, NJ 07002. [S; unusual, rare, gigantic]

GURNEY SEED AND NURSERY CO., 2nd and Capitol Yankton, SD 57078.

JOSEPH HARRIS CO., INC., Moreton Farm, Rochester, NY 14624.

C.C. HART SEED CO., 304 Main St., Box 169, Wethersfield, CT 06109.

H.G. HASTINGS CO., Box 4088, Atlanta, GA 30302.

HAZERA SEEDS, P.O.B. 1565, Haifa, Israel.

HENRY FIELD SEED AND NURSERY CO., 407 Sycamor St., Shenandoah, IA 51602.

HERBST BROTHERS SEEDSMEN, INC., 1000 N. Main St., Brewster, NY 10509.

R.L. HOLMES SEED CO., 2125 46th St., N.W., Canton, OH 44709.

HORTICULTURAL ENTERPRISES, Box 340082, Dallas TX 75234. [S; Mexican seeds]

A.H. HUMMERT SEED CO., 2746 Chouteau Ave., St. Louis, MO 63103.

ILLINOIS FOUNDATION SEEDS (IFS), Rt. 1, Tolono, IL 61880.

JACKSON AND PERKINS, Medford, OR 97501.

JOHNNY'S SELECTED SEEDS, Albion, ME 04910.

J.A. JUNG'S SEED CO., Randolph, WI 53956.

KNOWN-YOU-SEED CO., 26 Chung Cheng, 2nd Rd., Kaohsiung, Taiwan.

LEDDEN AND SONS, P.O. Box 7, Sewell, NJ 08080.

LE JARDIN DU GOURMET, Box 32, West Danville, VT 05873. [S; herbs, leeks to transplant]

LETHERMANS, INC., 1221 E. Tuscarawau St., Canton, OH 44707.

LIVINGSTON SEED CO., 880 Kinnear Rd., P.O. Box 299, Columbus, OH 43216. [C]

McFAYDEN SEED CO., LTD., McKenzie Seeds, P.O. Box 1600, Brandon, Manitoba, Can. R7A 6A6. [S]

McLAUGHLIN'S SEEDS, P.O. Box 550, Mead, WA 99021. [S]

EARL E. MAY SEED AND NURSERY CO., Shenandoah, IA 51603.

MIDWEST SEED GROWERS, 505 Walnut St., Kansas City, MO 64106. [W]

MELLINGER'S INC., North Lima, OH 44452.

MERRIMACK FARMER'S EXCHANGE, P.O. Box 470, Concord, NH 03301.

MORAN SEEDS, INC., 1155 Harkins Rd., Salinas, CA 93901. [C]

MUSSER SEED CO., INC., 1403 Chicago, P.O. Box 787, Caldwell, ID 83605.

NANCY'S PEPPERS, 2081 S. Woodcrest, Dehnam Springs, LA 70726. [S; peppers]

NATURAL DEVELOPMENT CO., P.O. Box 215, Bainbridge, PA 17502. [S; organic]

NIAGARA SEEDS, FMC Corp., Seed Dept., Box 3091, Modesto, CA 95353. [C]

NICHOLS GARDEN NURSERY, 1190 N. Pacific Hwy., Albany, OR 97321. [S; herbs, oriental vegetables]

NORTHRUP KING AND CO., 1500 Jackson St., N.E., Minneapolis, MN 55413.

L.L. OLDS SEED CO., P.O. Box 1069, Madison, WI 53701.

GEO. W. PARK SEED CO., INC., Greenwood, SC 29647

W.H. PERRON AND CO., LTD., 515 Labelle Blvd., City of Lavel, Quebec, Canada H7V 2T3.

PETOSEED CO., INC., Box 4026, Saticoy, CA 93003.

PORTER AND SON, SEEDSMEN, 1510 E. Washington St., Box 104, Stephenville, TX 76401.

REED'S SEEDS, R.D. #2, Cortland, NY 13045. [S; cabbage only]

REUTER SEED CO., INC., New Orleans, LA 70119.

MARTIN RISPENS AND SONS, P.O. Box 5, 3332 Ridge Rd., Lansing, IL 60438.

ROBSON SEED FARMS CORP., Hall, NY 14463.

ROGERS BROTHERS SEED CO., P.O. Box 1647, Idaho Falls, ID 83401. [W]

ROYAL SLUIS, INC., 1293 Harkins Rd., Salinas, CA 93901.

T. SAKATA AND CO., C.P.O. Box Yokohama No. 11, Yokohama, Japan 220-91.

SEABOARD SEED CO., Box 106, Bristol, IL 60512. [C]

SEED SAVERS EXCHANGE, Kent Whealy, R.R. 2, Princeton, MO 64673. [S; heirloom seeds]

SEEDWAY, INC., Hall, NY 14463.

R.H. SHUMWAY SEEDSMAN, P.O. Box 777, Rockford, IL 61101.

SIEGERS SEED CO., 7245 Imlay City Rd., Imlay City, MI 48444.

SILVERKNOBS FARM, R.R. 1, Lynnville, IN 47619. [S; gourds]

SLUIS AND GROOT OF AMERICA, INC., 124-A Griffen St., Salinas, CA 93901. [W]

N. SLUIS AND SONS, 922 W. Randolph St., Chicago, IL 60603.

STANDARD SEED CO., 931 W. 8th St., Kansas City, MO 64106. [C]

STOKES SEEDS LTD., INC., 3070 Stokes Bldg., Buffalo, NY 14240.

SUN SEEDS, INC., 9301 Bryant Ave. S., Bloomington, MN 55420. [W]

SUNRISE ENTERPRISES, Box 10058, Elmwood, CT 06110. [S; oriental vegetables]

G. TAITS AND SONS, INC., 900 Tidewater Dr., Norfolk, VA 23516. [S; kale, collards, upland cress]

TAKII AND CO., LTD., P.O. Box 7, Kyoto Central, Kyoto, Japan 600-91. [C]

THOMPSON AND MORGAN, Box 24, Somerdale, NJ 08083. [S; exotic and unusual]

S. TWILLEY, Box 65, Trevose, PA 19047.

W.J. UNWIN LTD., Dept. 305, P.O. Box 9, Farmingdale, NJ 07727. [S; vegetables,flowers]

D. VAN DER PLOEG'S ELITE ZADEN BV, P.O. Box 19, 2990AA Barendrecht, Holland. [W]

VAN DER BERG BV, P.O. Box 25, 2670AA Naaldwijk, Holland.

VAUGHAN-JACKLIN CORP., 5300 Katrine Ave., Downers Grove, IL 60515.

VERMONT BEAN SEED CO., Garden Lane, Bomoseen VT 05732. [S]

WILLHITE MELON SEED FARMS, Box 23, Poolville TX 76076. [S]

WILTON'S ORGANIC POTATOES, Box 28, Aspen, CO 81611. [S; organic, high altitude]

ILLINOIS POISON CONTROL CENTERS

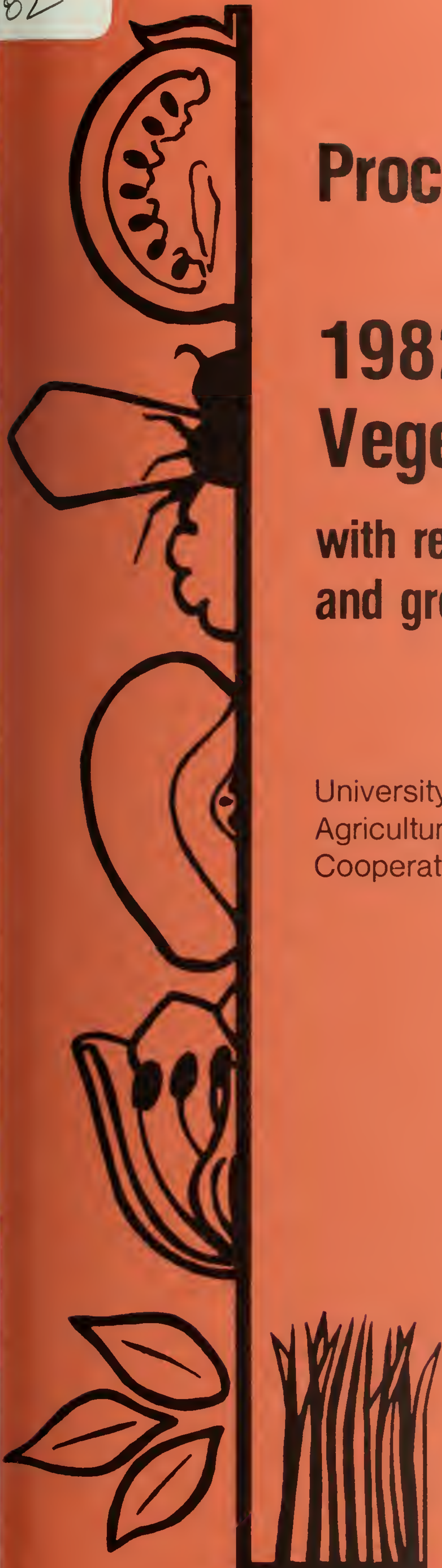
Three Poison Information and Resource Centers, are now operating in Illinois. These centers have 800 (toll-free) numbers. Trained specialists on poison information handle calls 24 hours a day. If necessary, the resource center will make referrals to local medical facilities for definitive treatment. Followup calls are made at 1/2-hour, 4-hour, and 24-hour intervals, depending on the toxicant. Additionally, local physicians receive reports about the patient to assure proper notification and continuity of care for each poison contact Staff members at the Poison Resource Centers are responsible for conducting public education and prevention presentations in each region on a routine basis.

Under the new system, the Illinois Department of Public Health has designated these hospitals as Poison Information and Resource Centers in Illinois:

Rush Presbyterian-St. Luke's Hospital, Chicago and Northeast Illinois
Dr. Jeffrey Matyas, Coordinator
1735 West Congress Parkway
Chicago, Illinois 60612
Telephone: 800/942-5969

St. Francis Hospital Peoria, Central and Northern Illinois
John Monroe, Director
530 Northeast Glen Oak
Peoria, Illinois 61637
Telephone: 800/322-5330

St. John's Hospital, Springfield, Central an
Southern Illinois
Donald VanFossan, Directo
800 East Carpenter
Springfield, Illinois 627
Telephone: 800/252-2022



Proceedings

1982 Illinois Vegetable Growers Schools

with research reports and grower suggestions

University of Illinois at Urbana-Champaign
Agricultural Experiment Station
Cooperative Extension Service, College of Agriculture

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Horticulture Series 31

FOREWORD

This Proceedings should serve as a reference for vegetable growers, industry representatives, extension personnel and research scientists. Its contents are a reflection of the ongoing research and extension activities at the University of Illinois with regard to vegetable crops. Contributors included scientists from the Department of Horticulture, the Plant Pathology Department and the Office of Agricultural Entomology, as well as the invited speakers at the Illinois Vegetable Growers Annual Meeting and Trade Show.

The 1982 Proceedings is a record of the information presented at the annual meeting and the regional vegetable schools held during the winter of 1981-82. It also provides current research findings and extension recommendations. As a multi-purpose publication, no one reader is expected to find all the information of value. Thanks and appreciation are due the commercial seed companies, agricultural industries, the Illinois Vegetable Growers Association and individual growers who support and participate in our research and extension programs.

Additional copies of this Proceedings are available for $4.00 each from the Department of Horticulture, 124 Mumford Hall, 1301 W. Gregory Dr., Urbana, IL 61801. Make checks payable to the University of Illinois.

John M. Gerber

John M. Gerber
Editor of Proceedings

This publication was compiled and edited
by John M. Gerber, Extension Specialist in Vegetable Crops
and Assistant Professor of Horticulture

URBANA, ILLINOIS JANUARY, 1982
Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914 in cooperation with the U.S. Department of Agriculture. William Oschwald, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign

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PLASTIC ROW COVERS FOR VEGETABLE CROPS IN CALIFORNIA

Bernaar J. Hall

PRESENTATIONS

Purpose

The purpose of row covers is to capture the sun's rays, warm a greater soil surface and heat the soil covered by the plastic. Air temperature usually increases from six to twenty degrees Fahrenheit inside the enclosed row cover area at mid-day. Also, soil temperatures were raised four to eight degrees Fahrenheit in the daytime to a depth of three inches. This extra soil heat collected in the daytime is released at night to maintain more rapid plant growth. In the San Diego County area of California, the crops matured three to five weeks earlier than paper hot caps. This early crop maturity has favored market conditions.

History

The use of plastic row covers had its beginning in 1958 with an early cucumber planting. An obtuse-shaped row cover was first used to force the early crop. This early planting matured a month ahead of the double paper hot cap planting. By 1960, practically all of the early spring cucumbers were started under plastic rows due to early maturity and favorable markets.

Staked tomato row cover trials started in 1960, and commercial plantings were made in 1962. By 1964, practically all of the early crop was started with plastic row covers either as an oval or as an inverted V-shape. Also, by this time growers had shifted to wire hoops in forming the shape. The standard hoop was 70 inches long, and made out of nine-gauge wire. Growers started with one five-foot, clear plastic sheet, with 1-1/2 mil thickness, then changed to two 36-inch wide sheets to simplify and reduce the cultural operations. Special strong clothespins were used to secure the two plastic sheets at the wire which was stapled to the stakes at the apex of the covers. By 1965, practically all of the early spring crops of cucumbers, tomatoes and squash were started under polyethylene plastic row covers.

Construction

Staked tomatoes. The normal staking method is to place two plants between each stake. Six foot, by one inch, by one inch, stakes are spaced three to four feet apart. A sixteen-gauge wire is stapled to the stakes at a 20 to 22-inch height. Nine-gauge wire hoops, 70 inches long, are spaced at alternate stakes. These hoops are forced into the ground covering an area of 26 to 28 inches wide and usually placed over the apex wire. The hoops are placed close to the stake. Two 36-inch plastic sheets with a haze of 12 to 20 percent factor are generally used to form the row covers. Six inches of plastic at the base of each side of the row cover are covered by soil in securing the base of the row cover. At the top of the row cover, the two sheets overlap three or four inches and are pinned to the apical wire with the special strong clothespins. Three to four pins are used between two stakes.

PRESENTATIONS

The two sheet construction allows ease of cultural operations from one side of the row cover. The clothespins are released and the plastic is dropped on one side, which is adequate space for weeding, pesticide application, as well as other cultural operations. Venting is simplified by pinning the top edge of the row cover to the hoops. One or two inches may be the first venting and this top space can be widened as the plant grows, or as the seasonal spring temperatures increase. Both sides of the plastic may continue to recede on the wire hoops until the entire row cover is open at the top. The plastic is then used as a windbreak for two to four weeks or until the early harvest begins. The early tomato crop is planted in January and the venting starts in February. The plastic is usually removed at the start of harvest or in May. Four to eight separate ventings are made in the process of opening the row covers. If temperatures are slightly unfavorable for natural fruit setting, chemicals are used as cluster sprays in securing fruit set.

Cucumbers and Squash. The construction of vine crop row covers is very similar to staked tomatoes. These crops are grown as bush plantings and do not need the tall stakes. Most growers use stakes one inch, by one inch, by 26 inches long, and drive these into the ground, giving a row cover height of 16 to 18 inches. These are spaced 10 to 15 feet apart in the rows. The apical, sixteen-gauge wire is stapled to the top of the stakes. The same width and type of plastic is used to form the row cover. The two soil edges of the plastic are covered with four to six inches of soil. The soil under the row covered area is the same as for tomatoes. The two sheets are also secured at the top wire with clothespins. Hoops are spaced four to eight feet apart down the rows in forming the shape which also keeps the plastic taut.

Planting crops in windy areas can be managed with extra hoops. These can be placed on top of the plastic and above the hoop under the plastic. In severe winds, twistems are used to secure the bottom hoop to the top one and also tied to the apical longitudinal wire. This construction has given good securement in fairly severe storms. Cucumbers and squash are more tender than tomatoes. They require slower venting or opening in conditioning the plants. They may be injured readily if they are opened too rapidly. Most growers use the plastic as windbreaks during harvest. This assists in fruit setting and also fruit quality.

Summary

Row covers have stabilized since the beginning in 1958, and are used mainly on four crops: tomatoes, cucumbers, squash and strawberries. A limited acreage to early peppers has been used. Many growers have reduced their application costs in installation with tractors. Twenty to thirty percent of the installation costs can be reduced with tractor plastic layers. Another variation that has been helpful in cultural operation is the use of perforated film. Perforations 1/4 inch in size on 3-inch spacing is standard for San Diego's climate. Whether one or two separate sheets are used, the perforated plastic produces a firmer plant growth.

Row covers used in vine crops and especially cucumbers are used as windbreaks at harvest. When light winds or normal breezes occur, these windbreaks intercept the air movement. In cucumbers and soft squash plantings, this reduces the fruit scarring from the foliage spines, resulting in higher quality fruit.

During the last five years, most of the row crops started under plastic row covers have been watered throughout the crops with drip irrigation. This relatively new method of irrigation has rapidly expanded with 85 to 90 percent of the county's row crops presently being irrigated by drip systems. This system increases yields, lowers water use, allows fewer weeds and creates less labor. Cultural operations can be performed at any time during the period of water application.

Bernaar J. Hall is a recently retired Farm Advisor for the University of California in San Diego County, CA. He spoke on row covers at the 1981 Illinois Fruit and Vegetable Growers Annual Meeting.

EDITORS NOTE: Research in Illinois has indicated that a single sheet of clear slitted plastic may be used successfully. This is simpler and less expensive to set up and maintain than the system outlined above. Wire hoops made of No. 9 wire were inserted in the ground at 6 foot intervals. The 5 foot wide slitted plastic was rolled out over the hoops and stretched tightly. The ends and sides of the row cover were held down with soil, creating a plastic tunnel. Two rows of slits allowed ventilation during the day. See page 48 "Effect of Plastic Mulch and Row Covers on the Yield and Earliness of Muskmelons".

DIRECT SEEDING OF TOMATOES FOR MECHANICAL HARVEST

Gerald E. Wilcox

Mechanization of all production operations has long been a goal of the tomato industry. Plant stand establishment by seeding as opposed to transplanting brings the industry a giant step closer to realizing that goal.

Besides the savings in time and labor, seeding offers these other advantages over transplanting for establishing plant stand:

1. lower cost per acre,
2. greater chance of disease-free seedings,
3. less dependency on outside labor and others in the planning schedule,
4. more flexibility in choice of variety and plant population, and
5. seeding operation completed faster and earlier in the season.

In spite of these advantages, many growers have been slow to adopt seeding methods, citing the following disadvantages:

1. difficulty in emergence,
2. competition of weeds,
3. the work of blocking out the plants,
4. lack of seeding equipment that properly places both seed and fertilizer.
5. necessity of thinning at the proper time, and
6. lack of suitable soil because of poor fertility or tendency to crust.

Recent research on seeding conducted at Purdue has now largely eliminated these objections.

If a grower decides to harvest his tomato crop mechanically, he must align his production practices to the requirements of the harvester, such as row width population, uniformity and variety. A mechanical harvester removes the entire fruit load at one time. Therefore, maximum yields require a maximum number of ripe fruit on each plant. The procedures presented in this publication for seeding of tomatoes should insure a reliable and uniform plant stand over a wide range of soils and result in a tomato crop well-adapted to machine harvesting.

The Integrated Seeding System

In the seeding operation, three factors are important considerations for obtaining maximum single harvest fruit yields--plant population, uniform seeding emergence and uniform rapid seedling growth.

Population in the 10,000 to 25,000 plant-per-acre range allows for fruit accumulation rates that result in top single-harvest yields. A uniform stand should be realized from a seeding rate of four to seven seeds per clump, from which two to four plants will usually be established. Also, placement on the seed of 1 pint of 10-34-0 analysis fertilizer per 500 feet of row promotes optimum growth rate of the seedlings after emergence and during the root development stage.

Finally, covering the seed with an anticrustant insures easy unrestricted seedling emergence. The probability of rain between seedling and germination is high during the spring planting season, and raindrop action often forms a crust over the seed that prevents or delays emergence. Use of anticrustant material can eliminate this problem.

Seedbed Preparation

Tomato seed responds to the proper environment, and that environment is a result of proper seedbed preparation. Fall-plow to a depth of 9 to 12 inches, incorporating the lime, phosphorus and potash fertilizer as recommended from the soil test. Then in the spring, till one inch deep to make a smooth seedbed. If spring-plowed, let the seedbed settle, preferably with rain, before seeding.

Tomato Planters

Several precision seeders are now on the market that will equally space the desired number of seeds in the row. By the term tomato planters, we refer to a machine that will precision seed, spray the seeds with starter fertilizer, fill the seed furrow with anticrustant material and also apply a herbicide. On tomato research plots at Purdue's O'Neall Farm, good stands have consistently been obtained with clump seeding using the Stanhay, Centra-Flo, John Deere 33, and the Dahlman seeders. All units have been modified to allow for application of starter fertilizer and anticrustant material as part of the seeding operation. Some tomato growers have fabricated their own tomato planters using the above seeders. A few have a soil tiller ahead of the seeder for tilling one inch deep. Thus, they till and seed in one operation. Best consistent results have been obtained by tilling only to a depth of one inch, and seeding in a firm seedbed.

Seeding Rate and Planting Pattern

For optimum single-row planting, space plants uniformly in a population range of 10,000 to 25,000 plants per acre. To achieve this, the planter should drop a clump of four to seven seeds every 6 to 10 inches in rows on 5 to 6-foot centers as determined by harvester requirements. This results in a seeding rate of about 1/2 pound per acre. The seed should be planted 5/8 to 3/4 inch deep with use of anticrustant for optimum emergence.

Twin row planting provides an increased fruit accumulation rate, and therefore, a greater single harvest ripe fruit yield. Space the twin rows 16 to 18 inches apart on 6-foot centers, with seed clumps every 9 to 18 inches in the row. Vine training is essential with twin rows.

Research in clump vs. single-seed planting indicates that clumps of two or more plants grow and develop as single plants with no sacrifice in yield. Precision placement of seed clumps by this seeding system eliminates the need for thinning.

Starter Fertilizer

Tomato seedlings have a very high requirement for phosphorus. Either spray fertilizer directly on the seed or place it in a band 1 to 2 inches directly below the seed. The fertilizer used, whether liquid or solid, should be low in nitrogen and high in phosphorus, preferably of a 1-3-0 or 1-4-0 ratio.

On Seed Application

Mix 1 pint of a 10-34-0 liquid fertilizer to 4 pints water, and apply the diluted solution at a rate of 1 pint per 100 feet of row. (Use at one-half this rate on sandy soils.)

Anticrustant Material

In seeding of tomatoes, use of an anticrustant is essential to insure uniform, dependable stands. In research tests over the past 3 years, several aggregate materials have proven successful in preventing soil crusting and in maintaining soil fracture over the seeding furrow. They include vermiculite, sawdust compost and ground corn cobs.

Anticrustant material is applied at a rate to just fill the furrow over the seed. For single-row planting, this amounts to 4 quarts per 85 feet of row or 14 to 16 cubic feet of material per acre, depending upon row and seed furrow widths. A positive feed unit to deliver the anticrustant through a tube directly ahead of the press wheel is most desirable. The tube opening should be about 2-1/2 inches long and 3/4 inches wide.

Flea Beetle Control

Apply Sevin or Rotenone on seedlings as soon as they emerge and again seven days later to control flea beetles.

Thinning

If thinning is necessary, thin when plants are small--second or third true-leaf stage. This minimizes competition and damage from root pruning. There is less shock, and plants recover more rapidly. It is not necessary to thin to single plants. Clump-thinning may be used. This leaves several plants at one location. Clumps develop and grow as single plants and give equal concentration of fruit set. In general, single plants may be thinned closer than clumps--singles 6 to 10 inches and clumps 9 to 12 inches from center to center. With twin-row planting, use the wider spacing.

Cultivating

Cultivate to control weeds only. Unnecessary trips across the field will compact the soil and add to cost. Keep root pruning to a minimum. Cultivate to promote growth, not to interfere with it. Build beds during cultivation and start moving soil to the plants early. Break up clods; do not move them into the vines. Use clod-breaking equipment freely: squirrel cages, rollers, floats, etc. After the clods are in the vines you can't get them, and consequently many find their way into the harvester.

Develop flat-top plant beds; humpback or swayback beds make harvesting difficult. Make the bed top wide enough to support vines with little or no hangover. Furrows should be equally spaced, no deeper than necessary, and of uniform depth.

Weed Control

Weed control is of major importance in the seeded tomato culture. Cost of hand weeding might be prohibitive.

Chemical weed control in tomatoes is a well-established practice. Applied at the proper time with good precision equipment, approved chemicals give good weed control. Poor results are usually due to poor timing in relation to rains, improper use of equipment, or poor follow-up of cultivation.

Planting Schedule

A typical schedule of planting is given in Table 1 that will spread the harvest period from mid-August to late September. Transplants are required for production prior to September 1-5. However, after this date direct seeding is preferred because of the greater crop uniformity possible with direct seeding.

TABLE 1. A tentative planting schedule for scheduling the harvest in the northern half of Indiana.

Method	Planting date	Variety	Approximate harvest date* (55-60% ripe)
Transplanted	May 10-18	Knox	8/23
		Chico III	8/27
		Campbell 28	8/25
		C 37	9/1
Seeded	April 20-30	Knox	8/29
		Chico III	9/3
		Campbell 28	9/1
		C 37	9/10
Seeded	May 10-14	Knox	9/5
		Chico III	9/9
		Campbell 28	9/7
		C 37	9/15
Seeded	May 20-30	Knox	9/13
		Chico III	9/15
		Campbell 28	9/17
		C 37	9/22
Seeded	May 30-June 7	Knox	9/28
		Chico III	9/30

*Use of Ethrel will advance the harvest date 4 to 7 days.

Summary of Production Practices

1. Fields rectangular with rows at least 600 feet long.
2. Soils of silt loam texture with good surface and internal drainage.
3. Seeded tomatoes planted in clumps, 5 to 7 seeds per clump, clumps 9 inches apart in single rows, 18 inches apart in twin rows.
4. Transplants of good quality set 16 inches apart in row.
5. Row width at 60 to 72 inches. Try some twin rows at 18 inches apart on 6-foot bed for seeded tomatoes.
6. Nitrogen rate at 50 to 90 lbs. per acre. Preplant or sidedress at first cultivation.
7. Use starter fertilizer.
8. Do not seed into deep fluffy seedbed.
9. Seed from April 23 to June 8.
10. Use anticrustant, if necessary. Recommended for most Indiana soils.
11. Transplants, variety, seeding, and planting dates can be used to schedule harvest. Use of Ethrel will increase ripe fruit load.
12. Use herbicides at planting and consider a later application if late weeds are a problem.
13. Use a pest and disease control program right up to harvest.
14. Keep soil under plants smooth and level to facilitate harvest.
15. Vine train to provide track for tractor and harvester wheels at harvest tim.
16. Concentrate ripe fruit with natural process (population, pattern, variety) and/or chemical treatment with Ethrel.

Ethrel Use for Increasing the Ripe Fruit Load

Apply 3-1/4 pints Ethrel or Cepha (0.84 lbs. of ethephon) in 10 to 75 gallons of water per acre. Spray directly on the plant with as complete covera of the fruit as possible. For optimum concentration of ripe fruit load, apply when 15 to 30 percent of the total fruit load is ripe. Harvest in the period 14 to 21 days after treatment for optimum benefit.

Gerald E. Wilcox is Professor of Horticulture at Purdue University. He spoke o direct seeding at the 1981 Illinois Fruit and Vegetable Growers Annual Meeting.

THE PRODUCTION AND PROCESSING OF SWEET CORN SEED

Wayne L. Lough

The Crookham Company of Caldwell, Idaho is a basic producer of sweet corn, popcorn, onion, carrot, lettuce and turnip seed. As a basic producer, the company grows seed for other seed companies and usually does not sell directly to growers. However, due to changes in the seed industry the Crookham Company is starting to offer corn hybrids directly to sweet corn processors.

The Crookham Company started production of open pollinated sweet corn and popcorn seed at Caldwell in 1911. It is now under the management of the third generation of the Crookham family. During the late 30's and early 40's the Crookham Company was one of the pioneers in the development and production of hybrid sweet corn seed. Through the years, more sweet corn has been produced by Crookham than any other single company and today it is the largest single producer of sweet corn seed. The company is also among the leading producers of onion, carrot and popcorn seed.

All of the seed is produced in Idaho. The lettuce, popcorn and sweet corn seed is produced within a 30 mile radius of Caldwell. Some of the onion and carrot seed is produced in this area, but much is grown in areas of southern Idaho somewhat removed from the sweet corn growing area. Caldwell is located near Boise in southwest Idaho and is about 150 miles from the large snap bean seed production area of south central Idaho.

There are several basic reasons why vegetable seed is grown in Idaho. One of the most important of these is the dry climate. There is very little rainfall during the growing season and the relative humidity is very low. The plant diseases that can attack vegetable plants and thereby reduce seed yield and quality require moisture for development and spread. They generally do not develop in Idaho under the dry conditions. A second reason for Idaho production is the availability of adequate supplies of irrigation water. Run-off from snow melting in the mountains is collected in reservoirs and is distributed throughout the farming areas through an extensive series of canals. The irrigation water is applied to the crops by running it in furrows between the rows. This keeps the water off the plants, but permits optimum yields. The third basic reason for Idaho seed production are the summer temperatures. During the growing season the days are warm to hot and the nights are cool. This combination seems to favor the development of high quality seed. Finally, the mild winters allow the biennial crops such as carrots, onions and turnips to over-winter in the soil. Biennials will flower and produce seed the season after the one in which they are planted.

Because of the quality and yield of the sweet corn seed that can be grown in southwest Idaho, the production of sweet corn moved to Idaho from the eastern U.S. many years ago. Idaho now produces about 95% of the U.S. sweet corn seed. This is a major part of the sweet corn seed grown in the world. The only other significant production of sweet corn seed is in Australia and New Zealand. Idaho exports sweet corn throughout the world with the major quantities going to Canada and Japan. Lesser amounts go to Europe, South Africa and South America.

Even though the cost of vegetable seed on a per acre basis is a small part of a grower's production costs, the cost per pound can be significant and is expected to increase. The continuing increase in the cost of seed is mainly du to the economic situation. Some of the increase is due, however, to the competi- tion for land in the Caldwell area. This competition is due to the large number of crops that can be grown there and to the number of vegetable seed companies in the area. Major crops grown other than the vegetable seed crops are alfalfa seed, winter wheat and sugar beets. Lesser quantities of potatoes, sweet corn for processing, onions, for fresh market and processing, field corn and other seed crops such as snap beans, lima beans and a few flowers are also grown. The need for isolation between crops of the same species also adds to the land competition. The production of hybrid seed requires the use of two inbred parents, one is the female and is detasseled and the other is the male which provides the pollen. In preparation for planting, seed of the male parent is stored in brown bags and seed of the female parent is stored in white bags for easy identificatio Both are labeled with stock seed number, hybrid number and date to be planted. The timing of planting is important since both must flower at the same time to allow pollination.

Near planting time, 12-15 lbs. of female seed and 4-6 lbs. of male seed per acre are delivered to the growers. They are sown so that 2 rows of male seed will be alternated with 4 rows of female seed. The male takes up a significant portion of the field which is then non-productive. The female plants are usually detasseled by hand since machine detasseling can damage the plant and reduce seed yield.

As the plants dry they are harvested either by combines or the whole ear may be picked. Combined corn must have a moisture content of 20% or less while ear harvested corn may be 40% or more. Generally, early maturing varieties that dry rapidly in the field are combined. The harvesters currently in use have not been manufactured for some time and are wearing out. Commercially available harvesters cannot be used for seed harvest because they do too much damage to the seed. The Crookham Company and some other members of the sweet corn seed industry have financed the development and manufacture of a new harvester which may be ready for the 1981 harvest season.

After harvest, the unhusked ears are trucked to the plant. After being weighed the corn enters a vibrator dump, dumped onto a belt, and is conveyed to metal boxes. The boxes are dumped into a husker which removes the husks. After husking the ears enter a sorting shed, where they are inspected. In the sorting shed the corn is run across a belt. The inspectors examine the ears and remove any that do not appear to belong in the crop. Any unhusked ears are sent back to the husker.

After the inspection the ears are placed in large bin dryers with bottoms made of metal screening. Hot air from the furnaces on the top of the dryers is forced through the corn. The air is about 105 degrees F. when it leaves the furnace and is about 95 degrees when it enters the bins. The corn, which can have a moisture percentage in the 40's at harvest, is dried to 10 to 12 percent moisture. The bins are 16 feet square and hold 30 to 45,000 lbs. of corn. The dried corn is conveyed out of the drier using underground belts. The belts elevate the corn up two stories to a sheller. This sheller which requires two men to operate it, was custom made by the Crookham Company.

The sweet corn seed crop at this point is a mixture of good seed, some poor seed and trash such as soil, pieces of cob and other matter. The seed processing will remove the unwanted particles and will separate the seed into grades or sizes. The corn first goes to a sizer which separates the corn into sizes such as large and medium, separates each size into rounds and flats and removes undersized and short kernels. The sized corn then goes to a mill which removes the over size seed and eliminates most of the dirt, trash, parts of seeds, cob pieces and other non-seed items. From the mill the seed goes to a gravity deck. Here a combination of vibration and air flotation is used to remove light kernels that usually have low germination and poor vigor. Cracked and moldy seed is also removed.

From the gravity deck the corn goes to a Sortex machine. The Sortex uses an electric eye to remove any discolored seed. Discolored seed can be those that are diseased, damaged by birds or insects, or may be field corn or other outcrosses. It will also remove yellow seed from a crop of white seed. After the Sortex, the seed can be hand picked. Sometimes discolored kernels are missed by the Sortex if the discoloration is small and is on the side of the kernel away from the electric eye. The hand picking usually removes any missed kernels.

The Sortexing is the final step of the seed processing. At this time two things can happen to the seed. Most of the seed will be treated, bagged and then shipped to whoever ordered it. Some seed is held for shipment at a later date. Seed that will be shipped immediately is sent to the seed treating machine and then to the bagger. A new electronic bagger will bag up to 30,000 lbs. per hour. It is accurate to 2 oz. per 100 lbs. Moisture readings are taken before, during and after drying. Both the company and its customers need to know the germination of the seed. The seed is wrapped in moist paper towels for the germination test. Each test consists of 400 seeds with 100 per towel. After the seed is placed on the towel it is rolled and placed in glass containers that retain moisture. The rolled towels are stored for 7 days. At the end of 7 days the towels are unrolled and the results recorded.

Wayne L. Lough is a representative of the Crookham Company of Caldwell, Idaho. He presented this paper at the Southeastern Vegetable Growers School in Collinsville, IL in December, 1980.

AGRICULTURE COOPERATIVES

George F. Astling

Producer cooperatives date back to the early 1800's when producers realized that benefits could be obtained by working together to market and process their products. These early cooperatives were fairly widespread, having been organized for local conditions to supply services for almost every important commodity. Over the years, much legislation has been written to encourage development and regulation of farm cooperatives. The Sherman Anti-Trust Act of 1890, the Capper Volstead Act of 1922, the Agricultural Marketing Act of 1929, the Revenue Act of 1962, and the Farm Credit Act of 1971 are some of the more important legislative measures.

In more recent times, cooperatives have begun to provide both marketing and purchasing operations in order to broaden their services. This necessitated special emphasis on the selection and education of the manager, employees, and directors. Through intensive educational and promotional programs, effective brand names have been established in the merchandising of products such as Ocean Spray, Sunkist, Diamond Walnuts, Land O'Lakes, and Welch Grape Juice. New organizational emphasis has been evident whereby through coordination, acquisition, consolidation, and merger, some commodity groups have developed a dominant position in the market place. The formation of large multi-market organizations such as the Mid-American Dairymen, Dairymen, Inc., and Area Milk Producers are examples in the dairy industry. The grain industry has formed Farmers' Export Coop. to increase sales; Ag Food, Inc., a federation of regional cooperatives for grain storage; and Central Farmers' Fertilizer, to supply basic fertilizers. Dried fruit producers have formed Sunland Marketing, Inc. from its three commodity groups under the 'Sun' label to market raisins, figs, and prunes. Through these approaches, the cooperatives have put emphasis on economic integration and coordination of commodity marketing systems as a means to enhance the growers' bargaining power.

Of nearly 7,700 agricultural cooperatives in the United States, 4,763 were marketing cooperatives, 2,775 were supply cooperatives and 181 performed related services. Total business conducted by these cooperatives exceeded $19 million. California, Minnesota, and Iowa were the top states in terms of business transacted by their cooperatives. Minnesota, Wisconsin, and Texas ranked as the states having the greatest number of cooperatives. Estimates place the amount of farm products handled by cooperatives at 27%, while they handle 18% of the farm supplies.

Cooperatives are operated by producers for their benefit through an elected board of directors. A manager and employees may be needed to conduct the daily operations of the cooperative. Membership is voluntary and generally open to anyone who could benefit from the services provided. All members share equally in voting while some cooperatives extend voting based on the amount of business transacted. The earnings of a cooperative are distributed to the membership on the basis of their participation. It has been noted that without an educational program, the average life of a cooperative is only one and one-half generations. For this reason, the educational program must be broad and include the public as well as the members, directors, management, and employees.

In order for a cooperative to operate at peak efficiency and provide its members with the best service, members should make every effort to utilize the services of the cooperative to the greatest degree. The by-laws of some cooperatives dictate that the members must market all of their product with the cooperative. Cooperative members who pack their own products must do so under prearranged specifications to ensure continuity of product for all the members. Since most cooperatives are formed with a minimum of capital investment, members usually receive payment for their product after the cooperative has marketed and received payment, usually 30-60 days. In the past, cooperatives have played an important role in the marketing of agricultural products. With proper development and organization, agricultural cooperatives still can make a significant contribution to the agricultural community.

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BACTERIAL SPOT OF PEPPER TOLERANCE STUDY

Barry J. Jacobsen, John M. Gerber and Randall K. Lindstrom

Bacterial spot caused by Xanthomonas vesicatoria has caused severe losses to bell pepper growers throughout the Midwest in recent years. Therefore, pepper varieties were evaluated for their resistance to bacterial spot of pepper.

Methods

Varieties were seeded on April 13, 1981 into Jiffy 7's and transplanted to the field on May 27, 1981. Each variety was replicated three times. Each replication required 12 plants spaced 2 feet apart, and rows 3 feet apart. Standard cultural practices were employed. On the evening of July 16, 1981, all plants were inoculated with the bacteria using a back pack mist blower with 18 hour old bacteria cultures. The culture used was isolated in 1980 from infected bell pepper grown in northern Illinois. Based on inoculation tests, this isolate was Race 1. Inoculum was at 1×10^8 viable cells per ml. Plants were sprayed to run off with this inoculum. Plants were rated for bacterial spot approximately two weeks later. Varieties used in this study are listed in Table 1.

TABLE 1.

	Variety Name	Source[1]
1.	GC-247	FM
2.	GC-X716	FM
3.	GC-X722	FM
4.	GC-X686	FM
5.	GC-246	FM
6.	GC-243	FM
7.	PI-163184	SRPIS-India
8.	PI-163189	SRPIS-India
9.	PI-163192	SRPIS-India
10.	PI-164471	SRPIS-India
11.	PI-164677	SRPIS-India
12.	PI-173877	SRPIS-India
13.	PI-182646	SRPIS-Guatemala
14.	PI-183439	SRPIS-India
15.	PI-183440	SRPIS-India
16.	PI-183441	SRPIS-India
17.	PI-183922	SRPIS-India

TABLE 1. (Continued)

	Variety Name	Source[1]
18.	PI-244670	SRPIS-India
19.	PI-246331	SRPIS-Ceylon
20.	Yolo Wonder L (VGR 566)	Asgrow
21.	VR 2 (564-1001)	PS
22.	PSX 2178 (060-6000)	PS
23.	Ruby King	Takii
24.	Yatsufsa Hot	Takii
25.	Hungarian Yellow Wax	Takii
26.	Early Niagara Giant	SS
27.	Lincoln Bell	SS
28.	Early Canada Bell	SS
29.	Staddons Select	SS
30.	Naples	SS
31.	Super Shepherd	SS
32.	Super Set	SS
33.	Big Bertha	PS
34.	Bell Boy	PS
35.	Gypsy	PS
36.	Midway	PS
37.	PSR 21476	PS
38.	PSR 2178	PS
39.	Market Master	Ball
40.	Delray Bell	PS
41.	Lady Belle (673/7306)	H
42.	SO/1806	H
43.	SAFR/88	H
44.	AyDR/1068A	H
45.	SB/1078	H
46.	Hybelle	H
47.	Early Calwonder (814922)	AC
48.	136 GE-2 (978005T	AC
49.	KRG #3 (948015T)	AC
50.	PI-271322	SRPIS-India

TABLE 1. (Continued)

	Variety Name	Source[1]
51.	Tasty Hyb (121003)	Ball
52.	Better Belle (4101)	Ball
53.	OPE 106	Burpee
54.	Exp. #1933	KS
55.	Fushimi Long Green	Takii
56.	Glory	Takii
57.	Express Bell	Takii
58.	New Ace	Takii
59.	Ace	SS
60.	Stokes Early Hyb	SS
61.	Citadel	PS
62.	Resistant Giant #4	Twilley
63.	Pennbell	H
64.	Yolo Wonder B	H
65.	PIP	Asgrow
66.	Cal Wonder	H
67.	Valley Giant	Ball
68.	Early Prolific	Ball

[1] FM = Ferry Morse, SRPIS = Southern Regional Plant Introduction Station, PS = Peto Seed, H = Joseph Harris Co., AC = Abbott and Cobb, Stokes Seeds, Keystone Seeds.

Results

No commercially available bell pepper was found resistant to the bacterial spot. One hundred percent of the plants of most lines were severely defoliated by bacterial spot. The varieties, PI-163189, AyDR/1068A, and Fushimi Long Green appeared to be segregating so single plants were selected from each.

Varieties that appear to be resistant are: PI-163192, PI-173877, PI-183439, PI-183927, PI-244670, PI-246331, and PI-271322.

No yield data were taken because the plot was uniformly infected with cucumber mosaic virus. Some individual plants from PI (plant introductions) were identified which were free of virus symptoms. Seed produced on these plants and from plants free of bacterial spot are being sent to Dr. A. Cook at the University of Florida for breeding purposes.

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VARIETAL RESPONSE OF DETERMINATE AND INDETERMINATE TOMATOES TO POTASSIUM APPLICATION IN A SANDY SOIL

David C. Warner and John M. Swiader

Tomatoes are one of the highest users of potassium (K) of all vegetable crops (2). Their peak demand for K comes late in the growing season (1) when soil K levels are usually low in sandy soils. The result in many cases is K deficiency during the period of tomato fruit development. In addition, the different fruiting habits of the numerous tomato varieties will also have a pronounced effect on K demand (3). The purpose of this study was to determine plant response to various K applications in a sandy soil for determinate and indeterminate tomato varieties.

Materials and Methods

This study was conducted at the Illinois River Valley Sand Field in Kilbourne, Illinois. The soil is a medium to fine sand with a cation-exchange capacity of less than 3 milliequivalents. Treatments consisted of the following K applications: 300 lbs/A applied preplant; 150 lbs/A applied preplant plus 150 lbs/A applied 4 weeks later; and control (0 lbs/A). Each treatment plot was split by determinate ('New Yorker') and indeterminate ('Jet Star') tomato varieties. Plants were sampled at designated intervals throughout the growing season and analyzed for tissue K. Soil analyses were made to check soil nutrient levels at early, midseason, and harvest periods. Plants were hand harvested in July and August with yield and quality measurements recorded.

Results and Discussion

Plant K uptake was consistently lowest in the control treatment at every sampling date (Table 1). Single or split application of 300 lbs/A increased leaf K considerably. However, for all treatments, K concentrations in leaf tissue generally decreased as the season progressed right up through harvest. Leaf K decreased to critical levels in both varieties during fruit development. Split application of the K fertilizer resulted in higher leaf K levels during fruiting. 'New Yorker' showed little effect in K uptake between single and split application of K fertilizer. In contrast, 'Jet Star' responded to side-dressing of K. Leaf K levels in 'Jet Star' were lower during the early growth period but increased noticeably during fruit development from split application of K.

TABLE 1. Leaf K levels in tomato varieties at 4 sampling dates for various K applications.

Sampling	'Jet Star' K Applied (lbs/A)			'New Yorker' K Applied (lbs/A)		
Date	0	300	150/150	0	300	150/150
		-%-			-%-	
6/11	2.7	3.4	3.3	3.2	3.6	3.9
7/8	2.4	3.8	3.4	2.1	3.6	3.6
7/29[z]	1.4	3.3	2.8	1.0	2.4	2.6
8/26[y]	0.9	2.0	2.7	--	--	--

[z]Corresponds to harvest for 'New Yorker' [y]Corresponds to harvest for 'Jet Star'

TABLE 2. Tomato yield and fruit quality as influenced by K application.

Applied K	'Jet Star' Total yield	'Jet Star' Fruit blotch	'New Yorker' Total yield	'New Yorker' Fruit blotch
(lbs/A)	(tons/A)	(%)	(tons/A)	(%)
0	15.7	90.5	6.7	72.6
300	18.3	74.4	10.9	59.0
150/150	19.1	54.2	12.6	52.1

K fertilization had a pronounced effect on fruit quality (Table 2). The incidence of blotchy ripening was noticeably reduced by K application. Sidedressing some of the K fertilizer later in the growing season further reduced fruit blotch, particularly in 'Jet Star'. Blotchy ripening has been correlated with low soil K levels in Florida (4). Our study reinforces this observation (Table 3). Sidedressing part of the K fertilizer increases soil K levels by 80 lbs/A late in the season. Fruit analysis for K, Ca, and Mg is currently in progress. Further observations can be made based on these results.

TABLE 3. Influence of K application on soil K levels for 2 sampling dates[z]

Sampling Date	K Applied (lbs/A) 0	300	150/150
		Soil K (lbs/A)	
7/8	50	180	250
7/29	45	120	200

[z]Sampling dates correspond to vegetative and fruiting periods, respectively.

David C. Warner is a graduate student in Horticulture and John M. Swiader is Assistant Professor of Horticulture.

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THE INFLUENCE OF MAGNESIUM-SULFUR COMBINATIONS ON TOMATO RESPONSE TO K FERTILIZATION

John M. Swiader

Many of the light-colored sandy soils throughout Illinois are critically low in magnesium (Mg). Soil tests have shown Mg levels as low as 40-50 lbs/A. This problem is further compounded when high rates of potassium (K) are applied to these soils. This study was initiated to determine the effect of Mg fertilization on tomato response when 300 lbs K/A is being applied. A secondary objective was to evaluate the use of sulfur (S) in combination with K-Mg nutrition of tomatoes on sandy soils.

Materials and Methods

The experiment was made up in a randomized complete block design with 3 replicates of the following combinations of K-Mg-S (expressed as lbs/A):

T_1 - Control

T_2 - 300 K, 0 Mg, 0 S

T_3 - 300 K, 80 Mg, 100 S

T_4 - 300 K, 80 Mg, 0 S

T_5 - 300 K, 0 Mg, 100 S

Treatments were applied by hand just prior to planting and disced down to a depth of 6 inches. The tomato variety was 'Campbell 1327'. Transplants were field set on 6/22 and harvested 9/3 and 9/10.

The soil was a Plainfield sand, medium to fine texture, with a cation-exchange capacity of less than 3 milliequivalents. Soil tests taken prior to the study showed approximately 80 lbs/A of potassium and 64 lbs/A of magnesium. Nitrogen (N) was applied at the rate of 110 lbs/A, split into a preplant and 2 sidedress applications. Weed control consisted of Treflan 4E applied at 0.63 lb aia two weeks prior to planting. Plots were irrigated with a portable-pipe system, when necessary.

Results and Discussion

Application of K, either singularly or in combination with Mg or S, or both, increased tomato yields (Tables 1 and 2). The largest yield increase was obtained when K-Mg-S were applied together. Both Mg and S enhanced the effect of K fertilization on tomato yields (Table 3). The Mg effect on K fertilization was slightly greater than that for S. However, when used together the yield increase was over 5 T/A.

S application increased Mg uptake in tomato leaf tissue under high rates of applied K (Table 1). Addition of S to Mg fertilizer increased Mg leaf concentrations by .17% (T_3 vs. T_4). Even without Mg fertilizer added, S by itself increased Mg uptake .08% (T_5 vs. T_2).

While these results are not conclusive, they indicate the possible value of Mg and S application when high rates of K are used on some sandy soils.

TABLE 1. Tomato yield and tissue response to K-Mg-S fertilizer combinations[z]

	Fertilizer Combination				
	T_1	T_2	T_3	T_4	T_5
ield (T/A)	11.60	14.90	20.10	17.10	16.30
issue K (%)	1.15	3.71	3.05	3.18	3.80
'issue Mg (%)	1.29	0.56	0.86	0.69	0.64

T_1 = control, T_2 = 300 K 0 Mg OS, T_3 = 300 K 80 Mg 100 S, T_4 = 300 K 80 Mg 0 S, T_5 = 300 K 0 Mg 100 S, expressed 14 lbs/A.

TABLE 2. Effects of K and K-Mg-S combinations on tomato yields

Fertilizer Combination	Yield Effect (T/A)
K-Mg-S	$T_3 - T_1 =$ 8.5
K-Mg	$T_4 - T_1 =$ 5.5
K-S	$T_5 - T_1 =$ 4.7
K	$T_2 - T_1 =$ 2.2

TABLE 3. Partioning of the effects of Mg-S fertilizer combinations on tomato response to K fertilization

Fertilizer Mg/S Partition	Yield Effect (T/A)
Mg-S	$T_3 - T_2 =$ 5.2
Mg	$T_4 - T_2 =$ 2.2
S	$T_5 - T_2 =$ 1.4

John M. Swiader is Assistant Professor of Horticulture.

SEEDLESS FRUIT PRODUCTION IN TOMATO

Steve Lin, William L. George and Walter E. Splittstoesser

The failure of tomato plants to set fruit is an important limiting factor affecting yield when plants are grown under adverse environments. Normally, the tomato plant produces fruit with seeds after pollination of the flowers and fertilization of the ovaries or miniature fruits. These processes are extremely sensitive to environmental conditions such as temperatures and relative humidities. In Illinois, in July and August, tomato production is often minimal when night temperatures are above 21°C (70°F). Although tomato plants can be grown under a wide range of temperatures, most of the current cultivars only set fruit in a narrow range of night temperatures, approximately from 15 to 21°C (59 to 70°F). Sensitivity to environmental extremes is also a characteristic of other members of the solanaceous family, particularly bell peppers.

Growth regulators, such as synthetic auxins, are used to induce parthenocarpic (seedless) fruit-set by growers in some production regions. However, poor fruit shape and quality are a problem when auxins are used. Also, fruit-set can be a problem in glasshouse tomato production due to the shedding of insufficient pollen. This is usually corrected by mechanically vibrating the flowers. Plant breeding offers an alternative method of dealing with the problem of poor fruit-set.

Although the selection of tomato cultivars which can set fruit under unfavorable environments is an important breeding objective, such breeding efforts have met with limited success. Examples are the short flower stigma types which allow easier self-pollination, and, more recently, the release of several heat-tolerant tropical breeding lines by the Asian Vegetable Research and Development Center in Taiwan. Most of the research has emphasized the selection of lines which undergo the normal fertilization process and set fruit under adverse temperatures. However, heat tolerance has low heritability; its inheritance is complex, and plant breeding is difficult. Also, heat-tolerant lines tend to exhibit poor horticultural characteristics, such as small fruit size. These problems have had limited breeding progress.

Parthenocarpic tomato plants set fruit naturally without seeds. Theoretically, they set fruit by circumventing the temperature-dependent fertilization process. Thus, the development of lines adapted to a wider range of environments using the parthenocarpic character might be possible.

In our studies, a tomato line, 'Severianin', from the USSR which has seedless fruits in some environments was used. Variation of the seedless (parthenocarpic) trait and the expression of other horticultural characteristics of this line were evaluated under glasshouse and field environments from 1978 to 1981. The effects of temperature on pollination and of emasculation (removal of the pollen-bearing portion of the flower) on the development and set of seedless fruit were examined in the field and in controlled environments. In order to evaluate the possible application of this trait in future breeding programs, some backcrosses were made to selected cultivars and breeding lines. The parthenocarpic trait is being incorporated into a glasshouse cultivar, a field cultivar, and a heat-tolerant breeding line through backcrossing.

The genetics of parthenocarpy of 'Severianin' was studied in crosses involving three seeded cultivars ('Ohio M-R 13', 'Heinz 1350', and 'C11d'). Parthenocarpy was evaluated by cutting mature fruit produced without emasculation in parental, F_1, F_2 and backcross populations. The data indicated that the inheritance of the parthenocarpic trait of 'Severianin' was controlled by a single recessive gene, pat-2. No cytoplasmic inheritance of parthenocarpy was revealed based on reciprocal crosses.

The general horticultural performance of 'Severianin' was evaluated under glasshouse and field conditions. 'Severianin' demonstrated better fruit-set without pollination than the control cultivars 'Ohio M-R 13' and 'Heinz 1350' under high temperature in glasshouse culture. Fruit size of 'Severianin' averages 3.5-4.5 oz. with complete locule fill even in the absence of seed. 'Severianin' appears to be highly susceptible to early blight. The parthenocarpic trait from 'Severianin' accounted for most of the heat tolerance in the progenies from crosses of 'Severianin' and the seeded cultivars. It may be possible to develop heat-tolerant cultivars or breed glasshouse cultivars which do not require pollination by using parthenocarpy governed by pat-2.

'Severianin' combined well with the three control cultivars used in this study. Some of the F_1's showed heterosis in fruit yield. No reciprocal differences were detected. Preliminary results suggest that it may be possible to use the parthenocarpic gene to develop breeding lines which set fruit under wider temperature regimes. Isolation of seedless lines with good horticultural plant and fruit characteristics continues.

Steve Lin was a graduate student and William L. George and Walter E. Splittstoesser are Professors, Department of Horticulture, University of Illinois.

EVALUATION OF PLANTING METHODS FOR PROCESSING TOMATOES

John M. Gerber

Several methods of stand establishment were compared for processing tomato production. Transplanting was compared with fluid drilling, precision sowing of raw seed and precision sowing of salt primed seed. Data were collected on the rate of seedling emergence and total yield in a simulated mechanical harvest. Plots were located at the Urbana Vegetable Research Farm on a heavy soil and at the Illinois River Valley Sand Field in Kilbourne, IL on a sandy soil. There were two planting dates at the Kilbourne location.

Materials and Methods

Treatments:

1. Transplanting. Six-week-old plants were set 12 inches apart.

2. Fluid drilling.Seeds were soaked in water for 48 hours until the seed coat separated and the radicle protruded from 2-4 mm. They were mixed in a colloidal gel (Laponite 508) and sown with a fluid drill at approximately 6 seed per foot.

3. Precision seeding. Raw seed were sown using a belt type planter with the belt punched to drop 5-9 seeds in clumps 12 inches apart.

4. Salt primed seed. Seed was soaked in a two percent potassium phosphate (KH_2PO_4) solution for 24 hours, dried at room temperature and sown as per treatment 3. (See page 27 "Salt Priming Tomato Seed for Improved Germination" for an explanation of this procedure).

Design:

Variety - Chico III

Plot size - Four 20 ft. rows each 5 ft. apart

Planting dates - Kilbourne Early Planting - April 20
Kilbourne Late Planting - May 29
Urbana Planting - May 25

Replicates - 4

Results and Discussion

All of the seeded treatments began to emerge within 7 to 9 days of planting. The fluid drilled, pre-germinated seed began to emerge 2 days earlier than the other treatments. Although there was little difference in time to first emergenc among the seeded treatments, the rate at which the fluid drilled seed emerged was more uniform. While all of the pre-germinated seed that was to emerge, appeared over a two day period, the dry seed continued to emerge over two weeks time.

The effect of pre-germination on uniformity of emergence rate may result in improved uniformity at harvest.

There were no significant differences in yield among the three seeding methods. Transplants out-yielded the seeded plants at Urbana, but this was probably caused by poor stands of the seeded plots. Without irrigation or timely rainfall, direct seeding can result in uneven stands and reduced yields. There was little yield advantage for transplants in the early planting at Kilbourne. Although the data were quite variable for the second planting, all seeded plots out-yielded the transplants (Table 1).

TABLE 1. Yield of processing tomatoes established with various methods.

Location and Treatment	Days to Harvest	Yield	Culls	Avg. Fruit Wt.
		(tons/Ac ± S.D.)	%	(oz.)
Kilbourne Early Planting:				
1. Transplanted	102	26.5 ± 2.0	22	2.2
2. Fluid drilled	116	23.6 ± 5.6	12	2.4
3. Precision sown	116	25.9 ± 2.9	12	2.3
4. Salt primed	116	21.8 ± 5.6	6	2.5
Kilbourne Late Planting:				
1. Transplanted	97	21.3 ± 3.9	10	2.6
2. Fluid drilled	125	30.4 ± 5.6	14	2.2
3. Precision sown	125	33.8 ± 5.0	15	2.2
4. Salt primed	125	31.4 ± 4.4	15	2.2
Urbana Planting:				
1. Transplanted	89	30.2 ± 5.4	4	3.2
2. Fluid drilled	101	21.6 ± 4.7	3	2.6
3. Precision sown	101	20.7 ± 1.1	17	2.5
Treatment Means:				
1. Transplanted		26.0		
2. Fluid drilled		25.2		
3. Precision sown		26.8		
4. Salt primed		26.6		

Although the transplants were already six weeks old at planting, there was only a two week difference between the time to harvest of the transplants and seeded plots at Urbana and in the early planting at Kilbourne. It may be possib[le] to eliminate this advantage by field seeding earlier, since seeded tomatoes are less likely to be injured by a late spring frost than greenhouse or southern grown transplants.

There was a 4 week difference between the transplanted and seeded plots in the later planting at Kilbourne. This wide gap between harvest dates may have been due to cool temperatures and slow ripening towards the end of the season. The use of growth regulators may have promoted more rapid ripening.

Although laboratory experiments indicated that salt-primed seed germinate faster than raw seed in cold soil, this was not observed in the field. There was no difference in harvest dates between the salt-primed and the untreated seed.

Future experiments will continue to evaluate the effect of various planting methods on earliness, uniformity and yield of processing tomatoes.

John M. Gerber is Extension Specialist in Vegetable Crops and Assistant Professor of Horticulture.

SALT PRIMING TOMATO SEED FOR IMPROVED GERMINATION

Jolant van den Haspel and John M. Gerber

Tomatoes grown in the north-central United States for processing into soup, juice and sauce are generally grown from transplants to insure an adequate stand. Direct seeding offers a means of stand establishment that requires less labor, a lower capital investment, and is generally faster than transplanting. A major disadvantage of direct seeding is the possibility of slow germination and emergence in cold wet soils during the early spring months. A seed treatment to increase the rate of germination would be an advantage to the grower. While gel seeding of pre-germinated seed may improve the rate of emergence, growers have been slow to accept fluid drilling. A seed treatment that would allow a grower to plant dry seed and still improve emergence might be better accepted.

Salt priming is a method used to initiate the germination process without allowing the radicle (young root) to emerge from the seed coat. The seed is soaked in a salt solution and then redried and sown as raw seed. During the initial soaking period, the germination process begins but is temporarily halted by drying.

Materials and Methods

Germination Study: Chico III tomato seeds were soaked in aerated solutions of two percent potassium nitrate (KNO_3), potassium phosphate (KH_2PO4), potassium chloride (KCl), and distilled water for 24 hours. After soaking, the seeds were rinsed with distilled water and allowed to dry at room temperature. Once the seeds were dried they were placed in a petri dish on moist Whatman No. 1 filter paper. The dishes were closed and placed in a growth chamber at either 55°F or 65°F.

The seeds were checked daily for germination as indicated by exposed radicles. As the seeds germinated they were removed from the dish and counted.

There were four soak treatments and an unsoaked control. Each was germinated under two temperature regimes resulting in a total of ten treatments (5 soaking x 2 temperature). There were four replicates of each treatment and 55 seeds per replicate.

The germination index, which is a relative value describing the rate of germination, was calculated according to the following formula:

$$GI = \frac{\text{Sum of } [(\text{No. seeds germinated each day}) (\text{No. days})]}{\text{Total No. of seeds germinated at end of experiment}}$$

Emergence Study: Chico III tomato seeds were soaked in aerated solutions of four percent potassium nitrate, potassium phosphate, potassium chloride and distilled water for 24 hours. Once the seeds were dry they were sown in sterilized greenhouse soil (1/3 sand, 1/3 peat, 1/3 field soil) at a depth of 1/4 inch. The flats were placed in either a heated greenhouse or a 60°F growth chamber and watered as needed.

The flats were checked daily for seedling emergence. The seedlings were counted and removed from the flat after the cotyledonary leaves were no longer touching the soil surface.

There were four soak treatments and an untreated control. Each was placed at two temperatures resulting in 10 treatments. There were two replicates of each of the 4 soaking treatments and 7 of the control. Each replicate consisted of 25 seeds.

The Emergence Index, which is a relative value describing the rate of emergence, was calculated according to the following formula:

$$EI = \frac{\text{Sum of [(No. of seeds emerged each day) (No. of days)]}}{\text{Total seeds emerged at end of experiment}}$$

Results and Discussion

There was little difference in the rate or percentage of germination of seeds in petri dishes at 65°F (Table 1). At 55°F salt primed seeds germinated several days earlier than both the control and the water primed seeds. The salt primed seeds reached 50% germination 2-3 days faster than the controls and the potassium phosphate soaking reached 80% germination 6-7 days earlier than the controls (Table 2).

TABLE 1. Percentage and rate of germination of tomato seeds at 65°F.

Priming Solution	Germination	Germination Index ± S.D.*	Days to 50% Germination ± S.D.*	Days to 80% Germination ± S.D.*
	(%)			
2% KNO_3	97.0	4.0 ± 0.5	3.8 ± 0.5	4.0 ± 0
2% KH_2PO_4	100.0	3.5 ± 0.5	3.8 ± 0.5	4.0 ± 0
2% KCl	100.0	3.7 ± 0.1	3.5 ± 0.6	4.0 ± 0
Distilled H_2O	93.0	4.0 ± 0.2	4.0 ± 0	4.0 ± 0
Control	100.0	4.1 ± 0.2	4.0 ± 0	4.0 ± 0

* S.D. is the standard deviation from the mean valve.

TABLE 2. Percentage and rate of germination of tomato seeds at 55°F.

Priming Solution	Germination	Germination Index ± S.D.*	Days to 50% Germination ± S.D.*	Days to 80% Germination ± S.D.*
	(%)			
2% KNO_3	94.0	10.6 ± 0.8	10.5 ± 0.6	13.5 ± 1.0
2% KN_2PO_4	99.0	10.4 ± 0.8	10.0 ± 1.2	10.5 ± 1.0
2% KCl	100.0	11.6 ± 0.6	10.3 ± 1.5	11.0 ± 1.8
Distilled H_2O	97.0	13.5 ± 0.6	13.5 ± 0.6	17.8 ± 3.0
Control	97.0	13.8 ± 0.8	12.6 ± 0.5	16.6 ± 1.1

* S.D. is the standard deviation from the mean value

The final percent emergence was greater for the salt primed seed than either water primed or untreated. This was true at both 60°F and ambient greenhouse temperatures. However, there was no significant difference in the rate of seedling emergence from the soil at either temperature.

TABLE 3. Percentage and rate of emergence of tomato seeds at 60°F.

Priming Treatment	Emergence	Emergence Index ± S.D.*	Days to 50% Emergence ± S.D.*	Days to 80% Emergence ± S.D.*
	(%)			
4% KNO_3	100.0	11.3 ± 0.7	11.0 ± 1.0	12.0 ± 0
4% KH_2PO_4	94.0	11.7 ± 0.1	11.0 ± 0	12.0 ± 0
4% KCl	100.0	10.8 ± 0.2	10.0 ± 0	11.0 ± 0
Distilled H_2O	86.0	11.1 ± 1.1	10.5 ± 0.5	12.5 ± 0.5
Control	88.7	11.9 ± 0.6	12.2 ± 1.2	13.7 ± 1.4

* S.D. is the standard deviation from the mean value.

TABLE 4. Percentage and rate of emergence of tomato seeds in the greenhouse.

Priming Treatment	Emergence	Emergence Index ± S.D.*	Days to 50% Emergence ± S.D.*	Days to 80% Emergence ± S.D.*
	(%)			
4% KNO_3	90	5.9 ± 0.5	5.5 ± 0.5	7.0 ± 1.0
4% KH_2PO_4	96	6.2 ± 0.4	6.0 ± 0	6.5 ± 0.5
4% KCl	94	7.8 ± 1.6	7.0 ± 0	9.0 ± 2.0
Distilled H_2O	84	8.6 ± 0.8	7.5 ± 0.5	11.5 ± 0.5
Control	94	7.2 ± 1.4	7.1 ± 1.2	8.7 ± 1.6

*S. D. is the standard deviation from the mean value.

Salt priming may prove to be a valuable tool if it improves germination and emergence under sub-optimal environmental conditions. While the primed seed germinated faster in petri dishes at 55°F, there was little effect of priming on emergence from soil at 60°F. It is possible, however, that salt priming will improve the rate of emergence of seeds (relative to unprimed seed) at temperatures less than 60°F. Studies will continue to evaluate the potential for salt priming as a cultural tool in tomato production.

Jolant van den Haspel was a visiting graduate student from Holland. John M. Gerber is an Extension Specialist in Vegetable Crops and Assistant Professor of Horticulture.

MAIZE DWARF MOSAIC IN NORTHERN ILLINOIS

Ellen B. Rest, Cleora J. D'Arcy and Walter E. Splittstoesser

Maize dwarf mosaic (MDM) affects corn (Zea mays L.) grown in the U.S.A. and in several other areas of the world. The disease was first reported in 1962 on field corn. However, since resistance to MDM was present in field corn lines and not in sweet corn, the disease has become more important in the sweet corn growing areas of the U.S.A. Most strains of maize dwarf mosaic virus (MDMV), the causal agent of MDM, overwinter in the perennial weed Johnsongrass [Sorghum halapense (L.) Pers.] and the disease has remained in areas where Johnsongrass occurs. However, since the early 1970's MDM has been found in areas where Johnsongrass does not survive. Large scale outbreaks of the disease have been reported from Minnesota, Idaho, and Wisconsin, and epidemics of MDM caused large yield losses in processing sweet corn in a non-Johnsongrass area of Illinois in 1977 and 1978.

Since there is no Johnsongrass in these northern areas, or because the non-Johnsongrass strain of MDMV has been reported, the source of MDM occurring in these areas is not known. There are several possible sources of MDM for the non-Johnsongrass areas of Illinois: (1) there may be another perennial weed in which MDM can overwinter. Since MDM has a large host range in the grasses, many of which are common field edge or roadside plants, it is possible that there are other perennials in which MDM can overwinter; (2) the virus may be transmitted in corn or weed seed. Since MDM is seed transmitted at low levels in field corn, some researchers have suggested this as a possible source of MDM for non-Johnsongrass areas. It is also possible that MDM is transmitted in seed from annual weed species; and/or (3) the virus may be transmitted over long distances by aphid vectors. Some researchers have proposed that aphids (Homoptera:Aphididae) may be bringing MDM from areas where it exists due to the presence of Johnsongrass.

A two-year study (1979-1980) examined each of the above possibilities at 17 separate locations near Rochelle, Illinois, where Johnsongrass is not present. The following conclusions were drawn from this study:

1. MDM occurrence in sweet corn at Rochelle during 1979 and 1980 was widespread over a large geographic area and over fields of varying ages. The virus appeared virtually the same time each year, 7/24/79 and 7/25/80.

2. The overwintering of MDMV in annual or perennial weeds in northern Illinois is not an important source of inoculum for this region. No MDMV was found in the weeds before it was found in the corn. MDMV infection of weeds does occur later in the season and many infected weeds were found in and around infected corn fields.

3. No seed transmission of MDMV in the sweet corn hybrid commonly grown at Rochelle was detected, eliminating this as a source of inoculum.

4. The maximum numbers of aphids caught in horizontal ermine lime traps were well correlated with the appearance of MDMV during both years. The aphid populations trapped at Rochelle contained 16 species which have been reported as able to transmit MDMV, and an additional 3 species which were tested for the first time and also found to transmit MDMV.

In summary, no local source of MDMV was found at Rochelle. These studies indicated that a non-local source capable of infecting large areas is responsible for the occurrence of MDMV in northern Illinois.

The results of this study contain several aspects that concur with the hypothesis that MDMV is spread over long distances by infected aphids. Entire fields of sweet corn became infected in short periods of time (three weeks). Many of these fields were uniformly infected, which does not support the idea that the infection was spread from weedy side areas. Also, during both years the large scale appearance of MDMV was related to increasing or maximum aphid numbers, implying a correlation between these two. However, it is impossible to determine the origin of the aphids accounting for the increase in populations. There could be a local build-up of aphids which developed wings at this time, seeking new host plants. In that case, the relationship seen between aphid numbers and MDM would be unclear but still present. Alternatively, the aphids could be migrating from the south central plains states where Johnsongrass is present.

In conclusion, this study lends support for the hypothesis that MDMV is spread over long distances by infected aphids. If MDMV is spread over long distances by aphids, then control of the disease will be difficult. Probably the most practical method will to to increase resistance to MDM in sweet corn through plant breeding programs.

Ellen B. Rest was a Graduate Research Assistant in Horticulture, Cleora J. D'Arcy is Assistant Professor of Plant Pathology, and Walter E. Splittstoesser is Professor of Plant Physiology in Horticulture.

YIELD LOSS OF SWEET CORN SUSCEPTIBLE AND RESISTANT TO MDMV

Mark A. Mikel, Cleora J. D'Arcy, Ashby M. Rhodes, and Richard E. Ford

Maize dwarf mosaic (MDM) is a severe disease of sweet corn in Illinois and throughout the midwestern and northeastern United States (3). The symptoms of MDM are a light green mottle initially most evident in the whorl. Yield loss expressed as reduced weight, length, diameter and partial sterility of the ear is common, in addition to stunting of the plant and delayed silking (1, 2). Earlier work showed no resistance to MDM in sweet corn, only tolerance in certain hybrids such as Cherokee, Golden Gleam, Silver Queen, Sundance, and Wintergreen (2). Workers in both industry and academia have begun transferring MDM resistance from highly resistant field corn inbreds (e.g., Pa 405, B 68) into sweet corn. The following is a report of the performance of a proprietary sweet corn hybrid with resistance incorporated from field corn, compared to two susceptible sweet corn hybrids, when inoculated with maize dwarf mosaic virus (MDMV).

Materials and Methods

In this study the sweet corn hybrids used were Seneca Scout and Golden Gleam, both susceptible to MDM, and VX 719, a proprietary hybrid believed to be resistant. Hybrids were planted on May 27, 1981 at Urbana, Illinois. Field spacing was 38 inches between and 13 inches within rows of 50 plants each, with 2 rows per experimental unit and a border of the same hybrid on either side. The experimental design was a split block with cultivars as main plots and treatments as sub plots, with three replications of main plots. The two treatments were inoculation at the 3- to 5-leaf stage and a noninoculated control. Plants were mechanically inoculated with 1:1 (v/v) mixture of MDMV strains A and B in 0.05 M sodium phosphate buffer, pH 7.0 with 1% carborundum added to aid inoculation. Plants were harvested 20 days after pollination which is fresh market maturity.

Results and Discussion

In general, the yield of Seneca Scout and Golden Gleam was reduced within MDMV treatments, but there was no adverse effect in the resistant hybrid VX 719 (Table 1). Delayed maturity, reduced plant height, ear length, weight, and kernel fill were all associated with MDMV infection in the two susceptible cultivars. However, in this experiment, very little difference was found between treatments for ear diameter and ear weight wasn't reduced as much as we have generally observed in previous work (1, 2). The reason may be that at Urbana, the summer of 1981 was an ideal year for sweet corn growth, with no moisture or heat stress. The proprietary hybrid VX 719 shows promise based on its apparent resistance to MDM. Further development and testing of new material for MDM resistance will continue in 1982.

Mark A. Mikel is Graduate Research Assistant in Plant Pathology, Cleora J. D'Arcy is Assistant Professor of Plant Pathology, Ashby M. Rhodes is Professor of Horticulture, and Richard E. Ford is Professor and Head of Plant Pathology.

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The authors wish to thank the Joseph Harris Co., Inc. for furnishing the proprietary hybrid VX 719.

TABLE 1. Response of three sweet corn hybrids to maize dwarf mosaic virus.

				Ear Characteristics				
Hybrid	Treatment	Days to Midsilk	Plant Height (cm)	Missing Kernels (mean No.)	Length (mm)	Diameter (mm)	Weight (g)	Second ears (no.)
Golden Gleam	C[x]	59.3a[y,z]	191 a	6.1 a	221 a	42 a	239 a	1.0 a
Golden Gleam	V	61.3 b	149 b	17.2 b	201 b	41 a	205 b	0.0 a
Seneca Scout	C	57.0 a	174 a	2.3 a	196 a	41 a	216 a	6.3 a
Seneca Scout	V	59.3 b	144 b	9.4 b	183 b	41 a	209 a	0.3 b
VX 719 (Resistant)	C	54.7 a	164 a	11.7 a	214 a	42 a	224 a	0.3 a
VX 719 (Resistant)	V	55.0 a	161 a	9.2 a	213 a	42 a	225 a	0.0 a
	$FLSD_{0.05}$	1.1	8	2.5	2	1	15	3.0

[x] Treatments: C = uninoculated control, V = MDMV-A + B inoculated.

[y] Data are means of 60 plants (20 per sub plot). Experimental design was a split block with cultivars as main plots and treatments as sub plots, with 3 replications of main plots.

[z] Values in column within cultivars having no common letter are significantly different (P = 0.05) according to Fisher's least significant difference (FLSD) test.

TRANSFERRING THE SUGARY ENHANCER GENE INTO NORMAL (SUGARY) SWEET CORN BACKGROUNDS[1]

Edward E. Carey, Ashby M. Rhodes and David B. Dickinson

Most sweet corn grown today is of the sugary (su) genotype. The sweetness of su corn at the eating stage is primarily due to sucrose accumulation, and its characteristic "creamy" texture is caused by accumulation of phytoglycogen (formerly called water soluble polysaccharide) (5). In recent years, other sweet corn genotypes with higher sugar levels than the su genotype have become available however these genotypes do not accumulate the texture-imparting phytoglycogen of the su varieties.

In 1967, a su corn line was found in the breeding program at the University of Illinois which was extremely sweet at the eating stage. Sucrose levels in this line, which was named IL677a, were found to be as high as those of the new high sugar types, while phytoglycogen levels were as high as those of su corn (4). The kernels were noted to have a pale yellow color, to be slow to dry during maturation, and were also found to accumulate unusually high levels of maltose during maturation (3). Genetic analysis of IL677a showed that the elevated sucrose level was due to a single recessive gene acting in combination with the su gene (1, 2). The gene was termed sugary enhancer (se) and the genotype of sugary enhancer sweet corn is abbreviated su se.

A breeding program was initiated to transfer the se gene from IL677a into other su germ plasm. Selection of su se kernels was based on enhanced sweetness at the eating stage, slowness of drying during maturation, and on appearance of the mature dry kernels.

The mature dry seed of 37 of these sweet corn lines harvested in 1979 was tested for the presence of the su se genotype by analyses for elevated maltose. Twenty-two of the lines were found to have the high maltose level of IL677a, with these levels varying between 0.46 and 4.20% of dry weight. Fifteen lines were found to have low maltose levels (less than 0.18% of dry weight) and were assumed to lack the se gene.

Sugar analyses of mature dry seeds of some of these lines during successive generations sometimes showed when the se gene was successfully transferred or apparently lost. Table 1 lists levels of maltose and other sugars in mature dry seed from successive generations of 6 sweet corn breeeding lines. Data for IL677a, the parent su se line, show that maltose levels were consistently elevated from year to year. Data for IL11a, a standard su inbred, show that maltose levels were consistently low from year to year. Sharp increases in the maltose levels in the seeds of ILB5840 and ILB5764 during successive years indicated the successful selection of pure su se individuals. A sharp drop in the maltose level of IL777a between 1977 and 1978 indicated that pure su se seed had not been selected for planting in the F_5 generation. ILB5868 provides an example where pure su se seeds from the F_3 generation were not selected for planting, and the se gene was lost.

Generally levels of the other sugars (primarily sucrose) were found to be highest in the mature dry seeds of the se lines and lowest in the seeds of the non-se lines, but this was not always the case as shown by the low levels of the other sugars in the se line ILB5840 and the high sugar levels in the non-se line IL777a. Although we have assumed that maltose is a good indicator of the presence of the se gene in homozygous form in su genotypes, other factors may be present in certain genotypes that can suppress the level of maltose.

TABLE 1. Levels of maltose and other sugars in the mature dry seed of sweet corn inbreds and breeding lines during successive generations.

Name of Corn Line	Year Grown	F Generation	Maltose (% of Dry Weight)	Other[1] Sugars (% of Dry Weight)
IL677a	1977	14	2.66	6.18
	1978	15	2.11	9.73
	1979	16	2.81	7.00
	1980	17	3.48	9.30
IL11a	1977	56	0.03	3.86
	1978	57	0.05	3.34
	1979	58	0.01	3.37
	1980	59	0.08	3.30
ILB5840	1977	2	0.29	2.57
	1978	3	2.71	3.44
	1979	4	4.20	3.36
	1980	5	3.04	3.27
ILB5764	1977	3	0.30	5.87
	1978	4	0.13	6.03
	1979	5	0.94	5.52
	1980	6	3.41	8.44
IL777a	1977	4	0.71	6.68
	1978	5	0.10	7.38
	1979	6	0.16	6.77
	1980	7	0.17	7.49
ILB5868	1977	1	0.06	2.97
	1978	2	0.03	4.94
	1979	3	0.46	8.26
	1980	4	0.11	4.80

[1]Other sugars = Fructose + Glucose + Sucrose. Sucrose was the predominant sugar in all cases.

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[1]This report is based in part on a thesis submitted by the senior author in partial fulfillment of the M.S. degree at the University of Illinois.

Edward E. Carey is a graduate research assistant and David B. Dickinson and Ashby M. Rhodes are professors in the Department of Horticulture.

EDITORS NOTE: See page 62, "A Classification of Vegetable Corns and New Cultivars for 1982," for a complete description of high sugar sweet corn varieties.

POSTHARVEST CHANGES IN SUGAR LEVELS OF SUGARY ENHANCER (su se) AND SUGARY (su) SWEET CORN

Edward E. Carey, David B. Dickinson and Ashby M. Rhodes

This study was undertaken to examine postharvest changes in sugar levels among 5 su se lines, and to compare them with changes in sugar levels in 2 su lines.

Sugary enhancer sweet corn (su se) produces sugar levels at the eating stage as high as those of the high sugar types (shrunken-2, brittle-2) while maintaining the desirable phytoglycogen levels of normal (su) sweet corn (2). Ears from each line were harvested at the eating stage (21 days after pollination) and frozen immediately or after 48 hours of storage at 2°C or at 30°C. Sugar determinations were made by gas chromatographic analysis of ethanol extracts of the kernels as described previously (1).

Results are reported in Table 1. In both su se and su lines, cool storage prevented sugar loss and warm storage showed considerable sugar loss. Total sugar levels in the su se lines exceeded those of the su lines at harvest and after both storage treatments. Sugar levels in the su se lines were so much higher than those of the su lines that even after 48 hours of storage at 30°C, the levels in the su se lines still exceeded those in the freshly harvested su lines. Sucrose was the major kernel sugar component in all lines, and changes in total sugar levels during storage were primarily due to decreases in sucrose.

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Edward E. Carey is a graduate research assistant, and David B. Dickinson and Ashby M. Rhodes are Professors in the Department of Horticulture.

EDITORS NOTE: See page 62, "A Classification of Vegetable Corns and New Cultivars for 1982," for a complete description of high sugar sweet corn varieties.

TABLE 1. Postharvest sugar changes in kernels of sugary enhancer and sugary sweet corn under two different storage conditions

Name of Line	Storage Treatment	Sucrose	Other Sugars[1]	Total Sugars
		% of Dry Weight		
I. Sugary Enhancer Lines (*su se*)				
IL677a	None	21.34	3.43	24.77
	2°C, 48 hrs.	21.59	4.01	25.60
	30°C, 48 hrs.	17.12	4.27	21.39
IL731a	None	24.06	3.74	27.80
	2°C, 48 hrs.	24.45	2.93	27.38
	30°C, 48 hrs.	17.98	3.72	21.70
IL775a	None	23.23	3.50	26.73
	2°C, 48 hrs.	24.60	3.69	28.29
	30°C, 48 hrs.	13.87	3.11	16.98
IL 776a	None	22.77	3.10	25.87
	2°C, 48 hrs.	20.92	2.99	23.91
	30°C, 48 hrs.	14.52	3.04	17.56
ILB5763	None	17.30	4.32	21.62
	2°C, 48 hrs.	13.85	3.74	17.59
	30°C, 48 hrs.	11.91	3.84	15.75
II. Normal Sweet Corn (*su*) Lines				
IL14h	None	9.28	2.96	12.24
	2°C, 48 hrs.	10.76	2.98	13.74
	30°C, 48 hrs.	7.53	2.80	10.33
IL451b	None	7.89	1.38	9.27
	2°C, 48 hrs.	8.11	1.33	9.44
	30°C, 48 hrs.	5.01	1.23	6.24

[1]Other sugars = Fructose + Glucose + Maltose + Sorbitol (a sugar alcohol)

RESULTS OF CORN EARWORM CONTROL TRIALS - 1981

Roscoe Randell

The efficacy of various materials for the control of earworm on sweet corn was evaluated. The study was conducted at the Urbana Vegetable Crops Research Farm.

Methods

Gold Cup sweet corn was planted on July 8 in single row plots with border rows between each plot. Plot size was a single row 230 feet long. The first application was made on Aug. 29 followed at 48 hour intervals between the first 3 applications and 74 hours between the 4th and 5th applications; dates of application were 8-29, 31, 9-2, 5, and 8. Three 25 ear samples were inspected from each treatment.

Results

		% Inf. ears		No. of worms in 75 ears					
		C.E.W.	E.C.B.	C.E.W.			E.C.B.		
Treatment	lb. ai/A			sm.	med.	lg.	sm.	med.	lg.
Untreated		100	10	152	158	42	10	7	2
Methomyl	0.45	7	3	4	0	1	0	1	0
Larvin	0.5	39	3	23	11	1	2	0	0
Larvin	0.75	15	0	8	7	0	0	0	0
DPX 3247 (1-5)	.25	24	3	19	8	0	2	1	0
DPX 3247 (1-5)	.50	4	1	2	1	0	1	0	0
DPX 3247 (1,2,3,5)	.25	21	9	13	7	1	5	2	0
DPX 3247 (1,2,3,5)	.50	9	1	7	3	0	1	0	0
DPX 3247 (1,3,5)	.25	65	12	24	41	5	6	3	1
DPX 3247 (1,3,5)	.50	28	1	6	14	3	0	1	0
DPX 3247 (1,4)	.25	91	13	73	90	24	12	2	0
DPX 3247 (1,4)	.50	81	1	44	73	3	1	0	0
Payoff	0.05	44	11	39	10	1	7	1	1
Permethrin	0.1	24	5	10	11	1	6	2	0
Lorsban + Sevin	0.5 + 1.5	20	3	4	7	4	2	0	0
MV 770	1.0	51	8	16	25	3	3	2	3

Roscoe Randell is an Extension Entomologist at the University of Illinois.

RESULTS OF CORN EARWORM CONTROL TRIALS - 1981[1]

Roscoe Randell and Chris C. Doll

Various materials were evaluated for control of earworm on sweet corn at Collinsville, IL.

Methods

Gold Cup sweet corn planted June 4 was divided into 16 row plots approximately 150 feet long. All plots were sprayed with a ground sprayer with 4 nozzles per row. The first application was made July 22. Four 25-ear samples were inspected from each treatment.

Results

Treatment		lb. ai/A	% Inf. ears C.E.W.	% Inf. ears E.C.B.	No. of worms in 75 ears C.E.W. sm.	C.E.W. med.	C.E.W. lg.	E.C.B. sm.	E.C.B. med.	E.C.B. lg.
Untreated			33	47	0	7	26	3	15	29
Methomyl	48 hr	0.45	0	2	0	0	0	0	0	2
Pydrin	144 hr	0.1	22	10	1	12	9	0	5	5
Pydrin	144 hr	0.2	14	10	1	4	9	6	2	2
Pydrin	96 hr	0.1	2	0	0	1	1	0	0	0
Pydrin	96 hr	0.2	2	0	0	2	0	0	0	0
Pydrin	48 hr	0.1	0	1	0	0	0	0	1	0
Pydrin	48 hr	0.2	0	0	0	0	0	0	0	0

Application dates: 48 hr. schedule - 7-22, 24, 26, 28, 30, 8-1, 3;
96 hr. schedule - 7, 22, 26, 30, 8-3;
144 hr. schedule - 7-22, 28, 8-3.

[1] Harley Willaredt, Collinsville was cooperating grower.

Roscoe Randell is an Extension Entomologist and Chris C. Doll is an Area Advisor with the University of Illinois.

RESULTS OF EUROPEAN CORN BORER CONTROL IN SWEET CORN - 1981

John L. Wedberg

Methods

Date of planting--------------------June 18, 1981

Variety and population--------------Jubilee; 19,500 plants/acre

Application method------------------CO_2 pressurized back-pack sprayer (40 PSI); two 8002 flat-fat nozzles per side, directed at the ear zone at 60 PSI

Experimental Design-----------------Randomized complete block; one row x 50 ft x 4 replicates

Application Dates-------------------September 13, 17, 21, 25, 1981

Date Evaluated----------------------October 4, 1981; 25 plants per treatment were evaluated

Results

Product	Lbs. Active Ingred./A	Percent Ears Infested[1]
Ambush 2E	0.10	0a
Bay FCR 1272 200 EC	0.044	1a
Ammo 2.5 EC	0.05	1a
Payoff 2.5 EC	0.08	2a
Orthene 75 S	1.00	3a
Pydrin 2.4 EC	0.20	3ab
Payoff 2.5 EC	0.04	5ab
Larvin 500	0.70	8ab
MV770 4 EC	1.00	8ab
Sevin 80S	2.00	12 bc
Lannate L.	0.45	13 bc
Larvin 500	0.40	18 c
Check	-	76 d

[1] Means followed by a common letter are not significantly different at the 5% level, Duncan's Multiple Range Test.

John L. Wedberg is an Extension Entomologist at the University of Wisconsin.

EFFECT OF CROPPING SYSTEMS ON VEGETABLE CROPS PRODUCTION

James E. Brown, Walter E. Splittstoesser, and John M. Gerber

In the United States, most commercial vegetable operations employ some form of a monoculture cropping system. Adequate availability of land and economic and labor constraints dictate this type of system for large scale vegetable production. On the opposite extreme, home gardeners rely primarily on hand labor for all cultural and harvesting operations. This allows gardeners to experiment with various methods of intensive planting that results in maximum production per unit land area.

A shifting economic environment has increased the potential for successful farming on a part-time basis. The increasing number of small farms depends on a moderate sized, 4-wheel tractor to help establish, maintain and harvest crops with a minimum of labor involved. Neither the highly intensive practices of the home gardener nor the monoculture system employed by large growers is likely to optimize profits on a small, 5 to 10 acre farm.

Many cropping systems for gardeners and large farmers have been investigated (1,3,4,6,7,8,11). However, there is a need to combine the technology of large-scale farmers with intensive cropping systems of home gardeners for the farmer who operates a 5 to 10 acre farm (9). This would allow the small farmer to select the proper mix of crops and cropping systems for maximum profit.

The objective of this study was to compare crop performance and productivity as they relate to the small farmer, using both monocropping and intercropping systems.

Materials and Methods

A. Tomatoes and Cabbage

1. Treatments

    a. Cabbage intercropped with caged tomatoes
    b. Cabbage alone
    c. Tomatoes alone

2. Design

    Sun-up cabbage was transplanted in 4, 30 foot rows with plants 12 inches apart on April 29, 1981. Jet Star tomatoes were transplanted on May 13, 1981, in 5, 30 foot rows with plants 30 inches apart and rows 38 inches apart. The intercropped plots had cabbage rows alternated with tomatoes at the same spacing as in the monoculture plots. Wire cages were placed over the tomato plants 3 weeks after planting. The cabbage was once-over harvested on July 2, 1981. Nine tomato harvests were made between August 11 and September 19, 1981. Weed and pest control were according to recommended practices with Treflan as the herbicide. Plots were irrigated as needed. There were 4 replicates of each treatment.

B. Muskmelon and Collards

1. Treatments

   a. Muskmelon intercropped with collards
   b. Muskmelon alone
   c. Tomatoes alone

2. Design

   Three foot wide, 3 ml black plastic was applied to 5, 30 foot rows, each 6 foot apart. Holes were punched at 2 foot intervals and Gold Star muskmelons were transplanted on May 22, 1981. For the intercropped treatment, Vates collards were seeded in 4 sets of double rows between each row of black plastic. The twin rows of collards were 18 inches apart and 30 feet long. The monoculture plots used the same spacing for melons as the intercropped plots, but collards were seeded according to standard grower recommendations in 5 single rows with 38 inches between rows. The collards were once-over harvested on June 30, 1981. Ten harvests were made of the melons between August 3 and August 25, 1981. Weed and pest control were according to recommended practices with 5% granular Dacthal as the herbicide. Plots were irrigated as needed. There were 4 replications of each treatment.

Results

Cabbage performed equally well under both cropping systems producing over 10 tons per acre. Tomato yield on the intercropped system was significantly less than that of the monocropped at 39 and 56 tons per acre, respectively. Size of tomato fruits produced under the intercropped system was comparable to that produced under the monocropped system (Table 1).

TABLE 1. Yield of intercropped vs. monocropped cabbage and tomatoes.

Treatment	Marketable yield/acre		Average size
	No.	Lb.(tons)	(oz.)
---------- Intercrop ----------			
Cabbage with tomatoes			
Cabbage	13,794	20,300 (10.2)	24
Tomatoes	245,194	77,440 (38.7)	5
---------- Monocrop ----------			
Cabbage alone	12,342	20,300 (10.2)	26
Tomatoes alone	344,269	111,539 (55.8)	5

Under the intercropped system, number of muskmelons produced per acre was reduced slightly but the growth of collards increased by 3.6 tons per acre relative to the monocropped system. Melon size was similar under both systems (Table 2).

TABLE 2. Yields of intercropped vs. monocropped muskmelons and collards.

Treatment	Marketable yield/acre		Average size
	No.	Lb.(tons)	(oz.)
Intercrop			
Muskmelons with collards			
Muskmelons	4,053	20,699 (10.3)	5.1
Collards	---	17,124 (8.6)	---
Monocrop			
Muskmelon alone	5,380	27,082 (13.5)	5.0
Collards alone	---	9,939 (5.0)	---

Discussion

The study showed that the cabbage-tomato and muskmelon-collard combinations may be used with satisfactory to excellent results. These crop combinations were grown on the same amount of land as each of the crops in the monoculture system. Therefore, one can expect economic return per land unit to increase under the intercropped system where individual crop yield was comparable to that of the monocropped system.

Tomato yield (Table 1) more than tripled that produced by conventional growers under both systems. This high yield may have been due to closer row and plant interval spacings than generally recommended for cage culture (2,10). Although tomato yield per acre was exceptionally high in both systems, that produced under the intercropped system was significantly lower than tomatoes grown alone. Observations during harvest suggest that this reduction was caused by nitrogen deficiency due to crop competition. Thus, it is probable that this reduction under the intercropped system can be prevented by increasing the nitrogen rate.

The slightly reduced yield of muskmelons under the intercropped system relative to the monocropped system may partially be attributed to crop competition for sunlight. Further, observations indicate that the tall vigorous collards grown between the rows of muskmelons could have been a barrier to bee activity, preventing proper pollination and reducing melon yields.

In contrast to the muskmelon results, collard yields under the intercropped system was nearly twice that of the monocropped system. The reasons for this increase in collard production is unknown. However, it is possible that the black plastic in muskmelon rows aided in heating the soil during early spring, thus promoting the growth of the collards.

The above evaluation suggests that the crop combinations used in this study can be gorwn with success. Integrated cropping systems may provide growers with alternative methods of production that have the potential of increasing productivity and profitability on small farms.

James E. Brown is a graduate student in Horticulture, Walter E. Splittstoesser is Professor of Plant Physiology in the Department of Horticulture, and John M. Gerber an Extension Specialist in Vegetable Crops and Assistant Professor in the Department of Horticulture.

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EFFECT OF PLASTIC MULCH, ROW COVERS AND HOT CAPS ON THE YIELD AND EARLINESS OF MUSKMELONS

John M. Gerber and James E. Brown

Various methods of increasing yield and improving the earliness of muskmelons for market have been employed by Illinois growers. Black plastic mulch and hot caps are two practices that may be beneficial, especially in the north. Plastic row covers are a relatively new method of improving earliness and yield of melons that is widely used in California. (See page 1 . "Plastic Row Covers and Unique Uses of Plastics for Vegetable Crops in California). This study compares black plastic mulch, hot caps, clear plastic slitted row covers, and covered and open solar trenches.

Materials and Methods

Treatments:

1. Check. Melons were seeded into bare soil.

2. Hot caps. Melons were seeded into bare soil and covered with paper hot caps.

3. Black plastic mulch. Three foot wide, 1.5ml black plastic was layed on level ground. Holes were punched in the plastic at specified intervals and melons were hand seeded.

4. Black plastic mulch plus row covers. Three foot wide black plastic was installed and melons were seeded as in treatment 3. Wire hoops made of No. 9 wire were placed over the mulch at 6 foot intervals and a slitted clear plastic sheet (5 ft. wide) was stretched over the hoops. The ends and sides of the row cover were held down with soil, creating a plastic tunnel.

5. Solar trench. An 8-10 inch deep furrow was dug and black plastic mulch was layed into the trench. Holes were punched at specified intervals and melons were seeded. A 4 ft. wide sheet of clear plastic was layed horizontally over the trench and slits were cut at 6 inch intervals to allow ventilation.

6. Uncovered trench. Black plastic was layed into a trench as described in treatment 5. No clear plastic cover was used.

Design:

Variety - 'Gold Star'

Location - Vegetable Research Farm, Urbana, Il. (Drummer silty clay loam soil type).

Plot size - Each plot was a single 20 ft. row with seeds sown 2 ft. apart and rows spaced 6 ft. apart.

Plot layout - Randomized complete block design

Planting date - May 20 - with replacement plants set on June 1.

Replicates - 4

Results

Emergence of the seeds was poor due to cold, wet weather following planting. Survival under the row cover and hot caps was significantly better than in the other treatments (Table 1). One replicate was abandoned entirely due to poor stands. Replacement plants (started in peat pots the same day as field seeding) were transplanted into plots where emergence was poor. Treatment 6 was abandoned since water had filled the trench.

TABLE 1. Percent emergence of muskmelon seedlings under environmental stress.

Treatment	Surviving Plants per Plot[1]	± S.D.[2]	Survival
	(No.)		(%)
Hot caps	10.0	0.0	100
Slitted row cover	7.0	1.0	70
Solar trench	1.7	1.5	17
Black plastic mulch	1.0	0.0	10
Check	0.7	1.2	7
Uncovered trench	0.3	0.6	3

[1]Each plot had a maximum of 10 plants.

[2]Standard deviation from the mean.

Plastic row covers dramatically increased both total and early yield. Hot caps increased total yield over the other treatments but early yield was quite poor. The check plot produced a large number of total melons, but few were of marketable size (Table 2).

TABLE 2. Yield and average weight of muskmelon var. 'Gold Star'[1]

Treatment	Early Yield[2]	Total Yield[3]	Avg. Fruit Wt.
	(number per acre)		(lbs.)
Slitted row cover	5203	8954	5.8
Check	1573	7381	2.0
Hot caps	847	6171	5.1
Black plastic mulch	2178	5082	5.4
Solar trench	1331	3872	4.9
Uncovered trench	0	0	0

[1] Data are from 3 replicates.

[2] Early yield is from the first 3 harvests from Aug. 15 - Aug. 21.

[3] Total yield is from 8 harvests from Aug. 15 - Sept. 5.

Conclusion

Plastic row covers should be tried by growers when the price of early melons warrants the investment in labor and materials. This may be the case for growers involved in direct sales or local marketing. Hot caps increased total yield, but the additional labor required to set and open the caps may not justify their use. The solar trench concept was ill-suited to heavy soils, especially during a year of above average rainfall.

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CAULIFLOWER RESPONSE TO NITROGEN APPLICATIONS IN A FERTILE SOIL

James E. Brown and John M. Swiader

Recently, questions have arisen by Illinois vegetable growers concerning the value of nitrogen (N) fertilization on cauliflower in highly fertile soils. Fertility recommendations differ in rate and timing of N application on cauliflower (1,2,3,4). In addition, high initial soil N levels would be thought to minimize any plant response to N fertilizer. This study was undertaken to provide preliminary information on the timing of N fertilization for cauliflower on a silty clay loam soil.

Material and Methods

Treatments consisted of N fertilizer applied as 34-0-0 at the following rates and times:

1. None.
2. 100 lbs. N/A at planting.
3. 100 lbs N/A 3 weeks after planting.
4. 50 lbs N/A at planting and 50 lbs N/A 3 weeks later.
5. 50 lbs N/A at planting and 50 lbs N/A 7 weeks later (at curd formation).

The remaining experiment design was in the following manner:

Variety - 'Snow Crown'
Location - Vegetable Research Farm, Urbana, Il (Drummer silty clay loam soil type)
Plot size Each plot consisted of four 12-foot rows with plants transplanted 2 feet apart within rows and rows spaced at 3 feet apart.
Plot layout - Randomized complete block design
Planting date - August 7, 1981
Harvest date - October 23, 1981
Replicates - 4

Results and Discussion

Cauliflower yields (Table 1) ranged from average (6.0 T/A) to excellent (12.4 T/A). Application of 100 lbs/A N at planting produced the highest yields. Split application with 50 lbs/A N supplied at planting and 50 lbs/A N sidedressed either 3 weeks or 7 weeks (curd formation) later decreased yields slightly. Delayed application of all 100 lbs/A N until 3 weeks after planting reduced yields significantly. Visual evaluation of vegetative plant growth showed no deficiency symptoms; however, curd size (Table 1) was greatly affected by N fertilization.

The results show that cauliflower does respond favorably to N fertilizer on fertile soils. Application of N at planting appears to be extremely important. In addition, visual plant appearance should not be used solely as a reliable indicator for the N nutritional status of cauliflower. While the initial results of this study provide some information on cauliflower nutrition, they strongly indicate the need for expanded research in this area.

TABLE 1. Cauliflower yield and curd size as influenced by N fertilization (rate and timing).

N fertilization (lbs/A)	Yield (T/A)	Curd size (lbs)
None	6.0	1.75
100 lbs at planting	12.4	3.60
100 lbs 3 weeks after planting	7.2	2.10
50 lbs at planting, 50 lbs 3 weeks later	10.7	3.10
50 lbs at planting, 50 lbs 7 weeks later[z]	10.3	3.00

[z]Timing corresponds to curd development stage.

James E. Brown is a graduate student in Horticulture and John M. Swiader is Assistant Professor of Horticulture.

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NORTHERN ILLINOIS VEGETABLE RESEARCH SUMMARY - 1981

Randall K. Lindstrom

A number of experiments were carried out at several sites in northern Illinois in cooperation with extension specialists and research faculty. A summary of the research at each location is outlined below. Complete information on specific treatments and results may be obtained from the author.

Pharmacognosy and Horticulture Field Station, Downers Grove, IL

A variety trial was conducted to determine which fresh market tomato varieties were best adapted to cage culture in northern Illinois. A number of varieties were selected for further evaluation in 1982.

A comparison of advanced breeding lines of processing tomatoes was conducted. Ratings were made on yield, earliness, and suitability for mechanical harvest. The varieties were submitted by the Northern Tomato Exchange Program (NTEP) cooperators. Results were reported to NTEP.

Pepper varieties and breeding lines were evaluated for susceptibility to bacterial spot (*Xanthomonas vesicatora*). A total of 68 varieties were inoculated with the organism. Although none of the commercially acceptable varieties proved to be resistant, 9 potential breeding lines were selected which demonstrated some degree of tolerance.

Several methods of increasing yields and improving earliness of muskmelon were tested. The most promising involved laying down black plastic and placing a clear plastic, slitted row cover supported by wire hoops over the plants. Increases in early yield were estimated to be 10 times over that of bare ground culture.

The homeowner horticulture phase of the field station conducted an experiment involving 14 treatments to control squash vine borers. A heavy infestation of cucumber mosaic virus killed the trial before results could be recorded. Certain treatments will be eliminated that proved impractical and the remaining will be repeated next season.

Agronomy Field Station, DeKalb, IL

Sweet corn varieties were evaluated for suitability for late season production. Several varieties were selected for further testing.

Agronomy Field Station, Elwood, IL

Sweet corn varieties were planted for evaluation for late season production. Inadequate rainfall following planting resulted in poor emergence and uneven stands. No data was collected.

Hoekstra Potato Farm, St. Anne, IL

A variety trial of processing tomatoes was conducted. A total of 28 varieties were tested for yield, percent culls, average fruit weight, and uniformity of fruit set. Several varieties were selected for further testing.

An experiment tested the effect of 4 secondary and micronutrient applications on processing tomatoes. Yield, percent culls, and average fruit weight were compared. Results were conflicting and the experiment will be repeated.

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ILLINOIS VEGETABLE CULTIVAR TRIALS - 1981

J. M. Gerber and J. Wilson Courter

Vegetable varieties were evaluated for yield and quality factors at several locations in Illinois. Varieties that have performed well in 1980 and 1981 are suggested for grower trial in limited plantings. Varieties that perform well over several years or at more than one location are adaptable to a range of environmental conditions.

Methods

Trials in 1981 were conducted at three University of Illinois Research Centers; 1) Dixon Springs Agricultural Center at Simpson, IL; 2) Vegetable Research Farm at Urbana, IL; and 3) Illinois River Valley Sand Field at Kilbourne, IL. Trials on farms were conducted in commercial fields in Union and Kankakee Counties.

The specific evaluations conducted, along with their respective locations are listed:

1. Main Season Sweet Corn Variety Trial - Urbana
2. High Sugar Sweet Corn Variety Trial - Urbana
3. Late Sweet Corn Variety Observation - Urbana
4. Late Sweet Corn Trial - Dixon Springs
5. Pepper Variety Observation - Urbana
6. Performance of Staked Fresh Market Tomato Varieties - Union Co.
7. Fresh Market Tomato Variety Observation - Urbana
8. Fall Tomato Trial - Dixon Springs
9. Processing Tomato Variety Trial - Kilbourne
10. Processing Tomato Variety Observation - Kankakee Co.
11. Muskmelon Variety Observation - Kilbourne
12. Watermelon Variety Observation - Kilbourne

Results

The specific trial results are available from either author upon request. Results of previous years' trials are also available (1,2). Several new cultivars were found to be worthy of grower testing on a limited scale. Recommended varieties are described on page 73 , "Vegetable Varieties for Commercial Growers".

Suggestions for grower trial:

Tomato: Duke, Royal Flush, Show Me, President, Jack Pot
Pepper: Hybelle, Skipper
Muskmelon: Ball 1776 (northern Illinois), Star Trek, Summet (early)
Sweet corn: Florida Staysweet, Penn Fresh ADX, Bellgold, Earliqueen, VX719
Late sweet corn: Seneca Sentry, Capitan
Bi-Color sweet corn: Burgundy Delight, Sweet Sal, BiQueen, BVX 819
Watermelon: All Sweet, Mirage

John M. Gerber and J. Wilson Courter are Extension Specialists in Vegetable Crops.

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EDITORS NOTE: See page 62, "A Classification of Vegetable Corns and New Cultivars for 1982," for a complete description of high sugar sweet corn varieties.

TRICKLE IRRIGATION

Leas L. Hill and John M. Gerber

Trickle irrigation is used extensively in the western and southern states where water and its costs are at a premium. These systems range in size from large commercial systems to small, home garden kits. Commercial uses of trickle irrigation in the Mid-west have been limited to greenhouses, tree fruits and some small fruits. However, trickle irrigation has advantages for intensive culture of high value, long season crops such as tomatoes or cucurbits in Illinois.

Trickle irrigation is a system of distributing relatively small but uniform amounts of water directly to the plant root zone. Trickle tubes or emitters supply an exact amount of water to provide optimum moisture conditions at all times and avoid periods of water stress. Trickle irrigation can be an important component of intensive management systems that may also include plastic and organic mulches, row tunnels, containers, and staking or caging. For this reason, high value fresh market crops have the greatest potential for use of trickle irrigation. Due to the fact that trickle irrigation wets only the soil around the plant roots, it is an efficient method of supplying supplemental water to plants.

Since only a portion of the soil surface is wetted, limited water sources and small pumps may be utilized. Weed growth between rows is not encouraged, erosion from runoff is reduced or eliminated, applied spray materials are not washed off, and less nutrients are leached from the soil. Precise amounts of fertilizer can be applied through trickle systems, and because the foliage of the plants is not wetted, disease problems are reduced. Also, with the specific instructions supplied by the manufacturer, small systems can easily be designed and operated by the grower.

Large systems require expert engineering and design to determine proper filtration, pumping, and field layout and installation. Service from the manufacturer or distributor is essential. A major problem for use of trickle systems (especially on strawberries) is they cannot be used for frost protection. Also, due to clogging problems and the possibility of damage from rodents, laborers or field equipment, trickle systems require a high level of attention.

A trickle irrigation system consists of three components: 1) a water source, 2) a delivery system, and 3) application lines and emitters.

Water Source

The water source can be a pond, lake, stream, well or municipal water supply. It should be large enough to supply water to the plants during the entire growing season. For example, to irrigate an acre of tomatoes with a trickle system, a pond with at least 1.5 acre feet of water during the driest part of the year would be required. If the water source is a well or municipal water supply, the flow rate must be at least 6.5 gallons per minute for the same area. Ground water from wells is generally excellent quality for trickle irrigation, and these sources should be utilized whenever possible. Salt and mineral content of the water should be within acceptable values (Table 1).

TABLE 1. Acceptable water quality values for trickle irrigation.

	Water Quality Values*	
	No problem (less than)	Severe problem (greater than)
1. Salinity		
Electrical conductivity		
(micromhos/cm)	750	3000
(millimhos/cm)	0.75	3.0
Concentration		
(ppm)	500	2000
2. Chloride (ppm)		
root absorption	142	355
foliar (leaf) applied	106	
3. Bicarbonate (ppm)		
foliar (leaf) applied	90	520
4. Boron (ppm)	0.5	1.0

*Values falling between these figures could potentially cause problems.

Delivery System

The delivery system consists of a pipe to move the water from the source to the field (usually PVC or polyethylene), a pump, filter, and a means of regulating the water flow (pressure regulator). The size of the main water line depends on the volume of water to be moved. Select the pipe size needed from the chart below, making sure to select a size with the ability to deliver more than the desired capacity of water.

TABLE 2. Pipe size vs. flow rate for trickle irrigation systems.

Pipe size	Flow
(inches)	
1/2	6 GPM
3/4	10 GPM
1	15 GPM
1 1/4	25 GPM
1 1/2	35 GPM
2	50 GPM

If a pump is necessary, it must be able to deliver the desired flow rate and pressure at the field. Friction of water in the pipe and contour of the land must be taken into consideration. Electric pumping units are preferred for most trickle irrigation systems for several reasons. They require a minimum of maintenance, they are easily automated with time clocks and other controls, and they are quiet. The pump selected should be capable of discharging a greater volume of water at the desired operating pressure than will be discharged through the emitters. This eliminates the possibility that the system will operate at a pressure too low for a uniform flow of water. Remember, the total pressure needed and the volume of water needed at the field is determined by the application system and must be known to select the proper pump.

Emitter clogging by physical and chemical contaminants is the single largest problem with trickle irrigation. Most systems require that the water be filtered through a 100-200 mesh screen. If the water contains a great amount of silt or particulate matter a centrifugal separator may be needed. Surface water sources (lakes, streams, ponds) are also contaminated by bacteria, algae, and other aquatic life which add to the clogging problem. Chemical treatment to remove these life forms is often necessary before a surface water source can be used successfully. Emitter orifice size and water quality are the parameters used to determine the type of filter. Usually a filter is selected which will remove all particles one-tenth the size of the smallest aperture in the system. Small secondary filters equipped with a 200-mesh screen installed in each lateral line are a safety measure.

Pressure regulators should be installed between the pump and applicator lines to control flow rates and prevent uneven watering due to surges in water pressure. These devices also compensate for elevation changes or losses due to pipe friction. They can be either fixed or adjustable and are usually installed at the head of the submain lines.

Pressure gauges should be installed between the pressure regulator and the applicator lines (usually at each submain) to monitor the pressure in the system. The pressure range of the gauge should match the system pressures for easy reading. It is also a good idea to install pressure gauges on each side of the filter to monitor performance and signal changes due to clogging.

Another necessary item for trickle irrigation systems is a vacuum relief valve. This device prevents the siphoning of dirty water back into the application system by the negative pressures created when the system is turned off. A one-inch vacuum relief valve for every 25 gpm of flow is sufficient and is installed immediately downstream from the pump.

Application System

There are two general types of application systems: line source emitters and point source emitters. Line source emitters are used for closely spaced row crops. This type of emitter is a series of equally spaced (4"-18") holes in a long, single, double, or triple chambered tube. They are best used on level ground, so as to maintain uniform discharge, with rows less than 300 feet long. Under these conditions, line source emitters give even distribution of water. Flow rates (rated as gallons per minute per 100 feet of tubing) are controlled by the spacing of emitter orifices along the tube. They are available in several grades of plastic (2-8 mil), operate under low pressure (5-15 psi), and some may be buried. The length of tube and spacing of emitter holes effectively irrigating each plant determines the amount of water each plant will receive.

Point source emitters are used for tree crops, container grown nursery crops, ornamentals, and greenhouse crops. These are individual emitters connected to a plastic supply pipe. Point source emitters are more expensive and last longer than do line source emitters. They also offer an important advantage in hilly or uneven terrain because pressure compensating emitters are available which will have the same discharge rate over a wide range of line pressures. Point source emitters operate under higher pressure (5-60 psi) than do line source emitters and their flow rate is controlled by varying the line pressure.

Trickle irrigation equipment costs vary greatly with the quality and type of components selected, the size of the system, and the crop to be irrigated. Line source emitters are available in several qualities and types and range in price from 2¢ to 8¢ per foot of tubing. Point source emitters are available for prices between $.28 and $1.15 each. Representative annual costs per acre for several crops are given in Table 3.

TABLE 3. Average annual costs per acre for various crops.

Crop	Annual Trickle Irrigation Costs/Acre
Apples	590.00[a]
Peaches	375.00[a]
Strawberries	1100.00[a]
Raspberries	335.00[a]
Blueberries	340.00[a]
Tomatoes	550.00[b]

[a]From: Economic Comparison of Trickle and Sprinkler Irrigation of Six Fruit Crops in Maryland, 1978. R. C. Funt, D. S. Ross, H. L. Brodie, Dept. of Agric. Engineering, University of Maryland, College Park, MD.

[b]From research at the Dixon Springs Agri. Center, Simpson, IL.

TABLE 4. Sources of trickle irrigation equipment.*

Agrifim Irrigation, Inc., 3081 E. Hamilton Street, Fresno, CA 93706
Chapin Watermatics, Inc., 740 Water Street, Watertown, NY 13601
Dramm Corp. USA, P.O. Box 528, Manitowox, WI 54220
Drip Irrigation Sciences Div., 5682A Research Drive, Huntington Beach, CA 92649
General Irrigation Co., Box 776, Carthage, MO 64836
Irri-Drip Systems, Inc., 870 E. Santa Clara Street, Ventura, CA 93001
A. M. Leonard, Inc., 6665 Spiker Road, Picqua, OH 45356
Mellingers, 2310 W. South Range, North Lima, OH 44452
Natural Resources Development Corp. of America Inc., 624 N. Elgin Parkway, Fort Walton Beach, FL 32548 (RIS Systems)
Rain Bird Eastern Sales Corp., 1883 Massaro Boulevard, Tampa, FL 33614
Redi-Rain Mfg. Co., Inc., 1037 W. Ninth, Upland, CA 91786
RIS Irrigation Systems, P.O. Box X, El Cajon, CA 92022
Submatic Inc., Box 246, Lubbock, TX 79408
Spot Systems Div. of Wisdom Industries, Inc., 1559 Sunland Way, Costa Mess, CA 92626
Trickle-Eez Co., 370 E. Marquette Woods Road, St. Joseph, MI 49085
Williamstown Irrigation, Inc., Box 169, Williamstown, NY 13493

*Inclusion or omission of a supplier does not imply a recommendation.

TABLE 5. Additional sources of information on trickle irrigation.

Drip/Trickle Irrigation Magazine, International Drip Irrigation Assoc., Box 288, Bloomington, CA 92316, Bimonthly $12.00.
Proceedings of Conferences, National Agricultural Plastics Association, Order from Dr. Franklin Schales, University of Maryland, Salisbury, MD 21801. (The 16th Conference is scheduled for September 16-20, 1981 in Cleveland, OH).
The Irrigation Association, 13975 Connecticut Ave., Silver Spring, MD 20906 (numerous publications and proceedings).
Trickle Irrigation: Guidelines for use in the home garden. Mich. State Univ. Farm Science Research Report 285. 7 pp.
Trickle Irrigation Design, Rain Bird, 7045 North Grand Ave., Glendora, CA 91740, Textbook, $10.45.
Trickle Irrigation in the Eastern United States. NRAES-4. $1.25. Order from NRAES, Riley Robb-Hall, Cornell University, Ithaca, NY 14853.

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A CLASSIFICATION OF VEGETABLE CORNS AND NEW CULTIVARS FOR 1982

J. Wilson Courter and Ashby M. Rhodes

Many new cultivars have been developed since 1978 when Rhodes described the different kind of genes and gene combinations that control sweetness in sweet corn. As a result of these new developments, growers must consider the genetic type when he plants his fields. Cross-pollination will turn some types starchy. This discussion is intended to bring growers up-to-date and to propose that breeders and seedsmen develop uniform terminology to classify and describe their forthcoming cultivars.

In the broad sense, vegetable corns include all corn harvested and eaten fresh while the kernels are tender and before all of the sugars are converted to starch. This definition includes "roasting ears" of selected field corns. The standard sugary (su) corns are being modified with other genes to develop new cultivars. Also, other gene mutants are being introduced into new cultivars resulting in a confusion of different genetic types of sweet corn. The genetic type is not readily identifiable by the name alone.

The genetic model classification (Table 1) is based on the endosperm of the edible corn. Except for sugary, the genes used in corn breeding act differently to produce the taste and texture deemed desirable for "sweet corn". The incorporation of all genes presently known or of all combinations of them are not necessarily feasible or available in commercial lines today. New genes may be discovered that will add to the listing. A listing of cultivars available for planting in 1982 are given in Table 2.

Growers must know their "corn genes" because cross-pollination among the different types will result in undesirable starchy kernels. Cultivars of the same genetic type may be planted side-by-side without a problem of cross-pollination. Otherwise, the following tips will help prevent cross-pollination by isolation of plantings.

1. A distance of 700 ft. provides complete isolation for scientific and plant breeding purposes. A distance of 250 ft. will give some contamination but not enough to materially affect quality.

2. Isolation can be enhanced by taking advantage of the prevailing wind direction.

3. Barriers and border rows will dilute contaminating pollen and therefore, isolation distances can be reduced.

4. Isolation can be provided by different time of planting or by different maturity of cultivars. There should be a 14-day minimum difference between timing or maturities to prevent significant cross pollination.

5. On a practical basis commercial growers should provide at least 50 feet separation. For example, plant the new genetic types 50 feet upwind to normal (su) sweet corn or field corn and use 4 or more border rows.

TABLE 1. Genetic model for vegetable corns: present and future.

I. Sugary (su) mutant

A. "Standard" sweet corn, all kernels express the sugary genotype (su).

B. Augmented sugary kernels. The sugars are increased by the action of other genes.

(1) Partial Modification

(a) Major effect genes: brittle (bt), brittle-2 (bt_2), shrunken (sh), shrunken-2 (sh_2), and sugary enhancer (se). About 25% of the su kernels are modified to obtain the benefits of the "major effect gene".

(b) When the sugary enhancer (se) gene is combined with one of the other major effect genes (for example the sh_2 gene) to modify some of the kernels, the result will be about 44% modification rather than 25%.

(2) 100% Modification

(a) Major effect gene sugary enhancer (se): To obtain the maximum benefit from this gene all kernels should be modified.

(b) Minor effect genes: dull (du), floury (fl), floury-2 (fl_2, opaque (o), opaque-2 (o_2), sugary-2 (su_2), and waxy (wx). Some of these genes are known to be present in some of today's sweet corn. Their presence is more by chance than choice.

II. Other mutants

A. Single gene:

(1) Shrunken types

(a) Shrunken (sh)

(b) Shrunken-2 (sh_2)

(2) Brittle types

(a) Brittle (bt)

(b) Brittle-2 (bt_2)

B. Multiple genes:

(1) Amylose extender (ae) + dull (du) + waxy (wx)

III. Starch corn selections, eaten immature.

TABLE 2. Terminology and genotypic examples of commercially available vegetable corns.

I. Sugary mutants

A. Standard sweet corn. The kernels contain moderate levels of sugar due to the su gene. This gene also causes the accumulation of water soluble polysaccharides (WSP) which gives a creamy texture to prepared sweet corn products. The rapid conversion of sugars after harvest is a major problem affecting quality.

Most cultivars listed in seed catalogs today are standard sweet corn. Other terminology includes "normal", "traditional", "conventional", and "sugar".

Standard sweet corn should not be cross-pollinated with "Extra Sweet" or ADX types.

Common examples of cultivars are Gold Cup, Golden Cross Bantam, and Silver Queen.

B. Augmented sugary. These types of sweet corn have modified sugar levels that are sweeter than standard sweet corn. The hybrid seeds resemble and germinate similar to standard sweet corn seeds.

Kernels of augmented sugary types become 100% normal sugary (lose their modification) when pollinated by normal sugary (su) corn. Their pollen, however, will not affect normal sweet corn.

(1) Partial (at least 25%) modification. Most cultivars released to date have a heterozygous combination of su kernels plus another gene that increases sugar, usually in a ratio of 3:1. The taste sensation is sweeter than standard sweet corn with little detectable difference in texture.

(a) Heterozygous shrunken. The (sh_2) shrunken gene has been incorporated in several cultivars which are called by various names: "synergistic", "bi-sweet", "sugary supersweets", and "Sweet gene hydrid". The latter is a registered trademark of Sun Seeds, Inc.

Cultivars: Bi-Color Synergistic, Honeycomb, Intrepid Synergistic, Sugar Loaf and Sugar Time.

(b) Heterozygous sugary enhancer. The (se) sugary enhancer gene has been incorporated into several cultivars. Descriptive terms for these cultivars include "sugary extender", "sugary enhanced", and "EH" ("Everlasting Heritage" or "E. H. Factor"). The latter term is a registered trademark of the Musser Seed Company.

Cultivars: Earliglow EH, Golden Sweet EH, Iosweet EH, Kandy Korn EH, Mainliner EH, Seneca Sentry, Tendertreat EH, Snow Queen EH, White Lightning, Platinum Lady, CR YW 8019, and CR 8002.

(c) Heterozygous shrunken and sugary enhancer. The ($\underline{sh_2}$) gene combined with the (se) gene modify the su kernels in a genetic ratio of approximately 9:7. This gives a modification of 44%.

Cultivars: Symphony (bicolor)

(2) 100% Modification.

(a) Homozygous sugary enhancer. Kernels containing this gene remain edible 4 to 5 days longer than standard sugary.

Cultivars: Silver Prince, Miracle, Remarkable, CR SE WY 8032

II. Other mutants

A. Single gene mutants. The brittle (bt) ($\underline{bt_2}$) genes and shrunken-2 ($\underline{sh_2}$) gene have been bred into new sweet corn cultivars known by growers and gardeners as "Super Sweet" and "Extra Sweet". These corn genes are descriptive of their effect on the appearance of the dry kernel.

(1) Shrunken types. Most familiar at the present time are the "Extra Sweet" types that express the shrunken-2 gene.

Cultivars: Candyman, Early Xtra Sweet, Florida Staysweet, Illini Chief Xtra Sweet, Sucro, Extra Sweet 77, Party-Time, Sweet-Time, Dinner-Time, Northern Sweet, Burpee Sugar Sweet, Hawaiian Super-sweet #1 and Hawaiian Super-sweet #5.

(2) Brittle types.

(a) Brittle gene = Hawaiian Super-sweet #9
(b) Brittle-2 gene = Hawaiian Super-sweet #6

B. Multiple genes. High sugar levels, similar to that in "Extra Sweet" kernels, can also be obtained through the combined action of other genes. At present the amylose extender (ae) gene, dull (du) gene, and waxy (wx) gene have been combined in one commercial cultivar - Pennfresh ADX.

The shrunken, brittle, and ADX cultivars must be isolated (in time or distance) from each other and all other corn as cross pollination will make their kernels starchy. Pollen from these types will make standard sweet corn (su) and augmented sweet corn kernels starchy.

III. Starchy corns used as vegetable corn are eaten immature before most of the sugars are converted to starch. These are called "roasting ears" or "green field corn". Selections used for this purpose include: Texas 17W, Texas 28A Hybrid, Texas Yellow Dent, and Truckers Favorite.

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HYDROPONICS

J. Wilson Courier and John M. Gerber

What is Hydroponics?

The term *hydroponics* is generally used to describe any of several methods of growing plants without soil. A number of packaged hydroponic systems are available for either commercial production or for use by hobbyists. These systems are variously referred to as water culture, aquaculture, gravel or sand culture, soilless culture, solution or liquid culture, nutriculture, or the nutrient film technique.

Hydroponic units built and operated by novices as business enterprises are, at best, very speculative ventures. As a back-yard hobby, however, greenhouse hydroponics may provide a worthwhile and challenging experience. Gardeners can extend the growing season, enjoy delicious winter vegetables, and learn important lessons about plant growth and environmental interactions. Careful record keeping will give valuable insights into economics, finance, and marketing, as well as into the fundamentals of intensive agricultural production.

Growing plants hydroponically is not magical. Equally good crops can be produced in greenhouses by conventional soil or bench culture systems, often with a lower investment. Hydroponics does, however, seem to capture the imagination of many people, among them those who conduct sales promotion campaigns and investors with surplus capital.

Greenhouse Production as a Business

Growing vegetables in greenhouses is one of the most intensive forms of agriculture known and offers one of the greatest challenges in the production of food crops. In recent years many developments have taken place in greenhouse structures, new cultivars, and methods of plant culture. Geographical distribution has also shifted from the Northeast and Midwest to the South and Southwest.

Someone recently stated, "The potential for greenhouse vegetable production has never been so great nor problems more critical." It has also been suggested that given the same skills and investment, the returns might be greater with ornamental pot plants or bedding plants.

The following points must be considered carefully when contemplating an investment in a hydroponic greenhouse for supplemental income.

Investment. A substantial investment is required for a greenhouse of commercial size. Costs may range from $3 to $10 per square foot of growing space, depending on the size and kind of structure. Although plastic greenhouses cost less initially, the annual fixed costs for a temporary type of construction are as high, if not higher, than for a conventional glass greenhouse. Further, hydroponic equipment increases the initial investment.

Operating Costs. One of the largest annual operating expenses is for fuel, and the outlook is not bright for holding this cost down. Keep in mind that plastic construction loses much of its economic advantage from the higher maintenance costs. Labor, if hired, is another high cost in growing crops in a greenhouse. While small units may be considered as a way to supplement the family income, the economics of this idea should be examined very carefully.

Labor Skills. A greenhouse business involves daily work and supervision. The intensive culture involved in growing vegetables requires good management and timely, skilled operations. The operator must have a thorough knowledge of the crops, pest control, horticultural practices, and environmental control. Often new owners and operators do not have this knowledge or experience.

Quality. Out-of-season, vine-ripe, top-quality produce can be grown in the greenhouse. However, high quality is not automatic. The grower must pay careful attention to light conditions, nutrient solutions, harvesting and handling, and marketing operations.

Yields. A profitable yield of vegetables is essential but not always easily achieved (see table below). Yield data based on greenhouses in the South or West cannot be translated directly into comparable performance in the Midwest. Light intensity and day length are limiting factors that determine planting dates, growing temperatures, and nutrient feeding, as well as cropping schedules, rate of growth, fruit set and development, and yield.

Realistic Yield Goals for Illinois

Crop	Pounds per square foot of greenhouse space
Tomatoes	
Fall crop	2 to 3
Spring crop	4 to 5
Lettuce	
Fall crops (2 or 3)	2 to 4
Spring crops (2 or 3)	3 to 6
Cucumbers	
Spring crop	4 to 6

Marketing. Carefully consider a market before building a greenhouse for vegetable production. Greenhouse produce harvested out of season will bring a premium price. The cost of a greenhouse is such, however, that not only high yields must be obtained, but also high prices.

Is there a sufficient market in the community to support the unit? Will restaurants buy the produce? Will local stores or chains buy for resale? In many communities the answer is yes, particularly when production is limited. Research in Ohio has shown that sales are reduced when there is a price differential of 20 cents per pound over field-grown tomatoes.

Summary

Hydroponic greenhouse vegetable production requires a significant investment in capital, labor, and skills.

Tomatoes are adaptable to hydroponic systems and, with proper management, will produce good yields at a time when local field tomatoes are unavailable. When the store competition is "green wraps" from Florida, California, and Mexico, vine-ripened tomatoes will find ready acceptance. The market, however, may be extremely limited in and around smaller towns and cities in Illinois.

Prospective investors should study the literature, visit greenhouse operations, and investigate possible markets. Certainly, there are opportunities in hydroponic growing, but such an investment must be carefully considered in relation to other possible investment returns on the capital involved.

The references listed below will be helpful in preliminary investigations. Learn as much as possible before deciding whether or not to invest in a hydroponic greenhouse.

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Here is a list of sources on hydroponic vegetable production. Most of the current references are available on request from the sources given. Some of the older references can be found in libraries.

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Supply Companies

Here is a list of commercial sources of hydroponics units and supplies. These companies may also provide information on hydroponic production methods. *No recommendation or endorsement for any of the companies listed is expressed or implied.*

Benbow Industries, Inc., P.O. Box 977, Apopka, FL 32703.

Brady Manufacturing, Box 134, R.D. 4, Jackson, NJ 08527.

Cambridge Farms, 8748 S. Tod Ave., Warren, OH 44481.

Canadian Hydrogardens, Ltd., 411 Book Rd., West, Ancaster, Ontario, Canada L9G 3

Clover Garden Products, Inc., Box 874, Smyrna, TN 37167.

Enclosures, Inc., 1 Main St., Moreland, GA 30259.

Hydroculture, Inc., P.O. Box 1655, Glendale, AZ 85311.

Hydro-Gardens, Inc., P.O. Box 9707, Colorado Springs, CO 80932.

Hygroponics, Inc., 3935 N. Palo Alto Ave., Panama City, FL 32401.

North American Greenhouse Co., Inc., Box 5286, Texarkana, TX 75501.

The Skaife Pipe Dream, 376 E. 8th St., Dubuque, IA 52001.

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Vegetable Varieties 1982
for Commercial Growers

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN/COLLEGE OF AGRICULTURE/COOPERATIVE EXTENSION SERVICE
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THIS CIRCULAR provides an up-to-date listing of vegetable varieties suitable for cultivation in Illinois. Since growing and marketing conditions vary widely throughout the state, it should be noted that not every variety is appropriate for every location. In making selections, therefore, growers should consider the preference of the local market, the length of the growing season, the methods of culture to be used, the diseases likely to be encountered, and the adaptability of the variety to the local soil and climate.

More specifically, growers should consider the following factors when choosing a variety: climate (temperature, rainfall, humidity), soil (type, fertility, drainage), cropping season (spring, summer, or fall), culture (planting distance, training method, type of mulch, fertilizer treatment), time of planting, method of harvest, and intended use (fresh sale or processing, storing or marketing). Since these factors vary in their influence on both performance and maturity for different locations in the state, growers should interpret the days to maturity figures loosely when selecting early and late varieties.

Hybrids. In the following entries, hybrids are followed by an asterisk (*). A hybrid is a cross of two parental lines or varieties that differ in at least one (but usually more) important characteristic. The resulting vigor is evidenced by improved growth and yield. Hybrid seed is usually more expensive than seed from open-pollinated varieties, and growers often find that hybrids are superior to older varieties because breeding has combined several desirable characteristics — such as disease resistance, quality, vigor, and uniform plant type, fruit type, and maturity — into one plant. However, hybrid seed may not always be the best choice when price is weighed against other relevant factors.

Tips on Testing. Growers are encouraged to test new varieties and hybrids to judge the potential for their area, use, or market. The following tips will help growers evaluate their own trials.

- Limit the number of varieties to be tested.
- Compare them with standard or favorite varieties.
- Select a location with uniform soil quality and drainage so that all varieties will receive the same spray and cultural treatments. Avoid planting at the edge of a field, where uncontrollable factors may influence results.
- Plant all varieties on the same day and in the same way, both in the field and in the greenhouse (for later transplanting). Be careful not to mix seeds or plants.
- Label each row or plant carefully. Draw a map and keep it in a safe place.
- Record observations of plant growth, yield, disease, and fruit characteristics. These records will help in making decisions the following year.

Other Sources of Information. Growers are also encouraged to consult current catalogs and trade publications for other promising varieties. Since one seed company cannot provide all the best varieties for each individual operation, several sources may need to be checked. A list of seed companies and distributors is included in Horticultural Facts VC-10-80, "Sources of Vegetable Seeds." Single copies may be obtained from county Extension offices or from the Department of Horticulture, 124 Mumford Hall, University of Illinois, 1301 W. Gregory Drive, Urbana, IL 61801.

Many of the vegetable varieties that show promise for Illinois have only recently been introduced and are still undergoing field tests. The latest results of those tests are included in the proceedings of the Illinois Vegetable Growers Schools, copies of which may be purchased either from county Extension offices or from the Department of Horticulture, 124 Mumford Hall, University of Illinois, 1301 W. Gregory Drive, Urbana, IL 61801.

Additional information on varieties of these and other vegetables may be found in Circular 1150, *Vegetable Gardening for Illinois*. Copies are available for $2 from the Office of Publications, 123 Mumford Hall, University of Illinois, 1301 W. Gregory Drive, Urbana, IL 61801. When ordering sale publications, make checks payable to the University of Illinois.

Explanation of Entries

The entries in this circular are listed in order of approximate days to maturity, which are indicated in parentheses after the name of the variety. Diseases to which the variety has resistance are entered in abbreviated form after each description. *Growers should note that resistance is to the common races or strains of plant pathogens in Illinois. Varieties may or may not be resistant to new strains that may develop.*

Key to Diseases

A	= anthracnose	F	= Fusarium wilt	RMV	= red mottle virus
A_1	= Alternaria	FBR	= Fusarium basal rot	Sc	= scab
ALS	= angular leaf spot	IC	= internal cork	SCLB	= southern corn leaf blight
Br	= blackrot	LB	= late blight	Sm	= smut
BS	= bacterial spot	MDM	= maize dwarf mosaic virus (tolerance only)	SW	= Stewart's wilt
BV_1	= common bean mosaic	N	= root knot nematodes	TEV	= tobacco etch virus
BV_{15}	= New York strain bean mosaic	NCLB	= northern corn leaf blight (Race 1)	TMV	= tobacco mosaic virus (most strains)
BW	= bacterial wilt	NN	= net necrosis	V	= Verticillium wilt
CB	= Cerospora blight	PM	= powdery mildew	YR	= yellows resistant
CMV	= cucumber mosaic virus	R	= rust		
DM	= downy mildew				

ASPARAGUS

Jersey Centennial* –trial	New early hybrid ready for trial in Illinois. R,F.
Mary Washington	Standard commercial strain, early. Large, dark green spears with purplish tinge. R.
Waltham Washington	Productive variety. Dark green spears with purplish tinge. R.

BEAN, SNAP (green)

Contender (50)	Nearly round, slim pod, buff seeded. Well-adapted, standard stringless variety. BV_1.
Spartan Arrow (51)	Oval bean, buff seeded, concentrated set, straighter pod than Contender. Well adapted in Midwest for shipping or local marketing. BV_1,BV_{15}.
Astro (52)	Round pod, white seeded, concentrated set. Productive, suitable for shipping or mechanical harvesting. BV_1,BV_{15}.
Green Genes (52)	Flat pod, white seeded. Improvement of Greencrop for local sales where flat pod is desired.
Provider (52)	Standard round bean, purple seeded, concentrated early set. Suitable for shipping or local marketing. White-seeded Provider has improved pod type and matures 2 to 3 days later. BV_1,BV_{15}, RMV.
Early Gallatin (53)	Round pod, white seeded. Tender, excellent for freezing. BV_1,BV_{15},RMV.
Bluecrop (54)	Round pod, white seeded, excellent flavor. Standard for local markets.
Cascade (54)	Round pod, white seeded. Excellent quality for local markets. BV_1,BV_{15}.
Harvester (54)	Round pod, white seeded. Adapted for mechanical harvesting and shipping. BV_1,BV_{15}.
Sprite (54)	Nearly round pod, white seeded. Suitable for fresh markets. BV_1.
Tenderette (54)	Round pod, white seeded. Adapted for machine harvesting. BV_1,BV_{15}.
Tendergreen, Improved (54)	Nearly round pod, purplish-tan seeded. BV_1,BV_{15}.
Eagle (55)–trial	Round slender pod, white seeded. Suitable for freezing and local marketing. BV_1,BV_{15}.
Del Ray (56)	Round pod, white seeded. Upright plant adapted for machine harvesting.
Tendercrop (56)	Round pod, white seeded, spreading bush. Excellent quality for local markets. BV_1,BV_{15}.

BEAN, SNAP (yellow)

Resistant Kinghorn Wax (50)	Standard yellow wax bean, round pod, white seeded. Good for processing. BV_1, BV_{15}.
Resistant Cherokee (52)	Standard yellow wax bean, oval pod, black seeded. Well adapted for shipping and local marketing. BV_1.
Moongold (54)	Round golden pod, white seeded, straighter pod than Kinghorn Wax.
Midas (55)	Slender, short pod, white seeded, concentrated set. BV_1,BV_{15}.
Goldcrop (55)	Round, straight pod, white seeded, upright plant. Well adapted, All-America Selection. BV_1,BV_{15}.
Sungold (56)	Round, bright pod, white seeded. Attractive color and appearance for local markets. BV_1,BV_{15}.

BEAN, LIMA

Henderson Bush (65)	Standard baby lima, pale green seed.
Thorogreen (66)	Early baby lima, excellent quality, green seed. Selection from Henderson Bush but less heat tolerant.

Thaxter (70)	Baby lima, similar to Thorogreen, greenish white seed. Developed for processing, improved yields under mildew conditions. DM.
Fordhood 242 (74)	Standard bush lima. Uniform, large, greenish white seed, large plant. Sets under adverse conditions.

BEET

Gladiator (52)	New early processing type with good color.
Ruby Queen (55)	Widely used. Uniform round root, suitable for processing or marketing.
Detroit Dark Red (60)	Globe-shaped root with good color, suitable for processing or marketing.
Crosby Green Top (60)	Erect green tops suitable for bunching.

BROCCOLI

Green Comet* (60)	Uniformly large head. Suitable for early marketing.
Green Duke* (70) –trial	Similar to Green Comet but matures 10 days later. Ready for trial in Illinois.
Premium Crop* (75)	Large single head, main season variety. Good for mechanical harvesting.
Waltham 29 (80)	Standard for fall crop, good for freezing or local marketing.

BRUSSELS SPROUT

Green Gem* (85) –trial	Early hybrid suitable for freezing and fresh marketing. Ready for trial in Illinois.
Jade Cross E* (92)	Consistently high yields, widely used.

CABBAGE (fresh market head)

Market Victor* (65)	Early hybrid. Solid round head with bright, blue green color. YR.
Stonehead* (70)	Early hybrid. Small, solid head. YR.
Ruby Ball* (72)	Solid, round head with deep red color. YR.
Market Topper* (73)	Medium-sized, solid head, for second early crop. YR.
Market Prize* (75)	Round, firm, uniform head, excellent shipper for main season crop. YR.
Red Head* (83)	Firm, slightly flattened head with deep red color, for main season crop.
Resistant Danish* (95)	Medium-sized, solid, slightly flattened head, suitable for late season fresh markets. YR.
Red Danish* (97)	Late season red head, suitable for storage. YR.
Danish Ballhead* (100)	Late season variety, suitable for storage.

CABBAGE (fresh market savoy)

Savoy Ace* (75)	Finely curled, round head. YR.
Savoy King* (85)	Large, moderately curled head, tolerant to blackrot.
Chieftan Savoy (90)	Standard, late season savoy.

CABBAGE (processing)

Titanic* (73)	Solid head, used especially for kraut. YR.
King Cole* (74)	Can be used fresh or for kraut. YR.
Roundup* (78)	Widely adapted hybrid. YR.

CARROT (fresh market)

Spartan Fancy* (70)	Good color, early. CB.
Dominator* (73)	Long, slender root, good color.
Hi-Pak* (77)	Widely grown, vigorous, good color.
Trophy* (78)	Smooth, uniform root, good clear color for cello-pak.
Gold Pak (79)	Not as early as hybrids but widely used. CB.
Grenadier* (79)	Slender, Imperator type for cello-pak. CB.

CARROT (processing)

Scarlet Nantes (75)	Uniform cylindrical root, suitable for slicing.
Red Cored Chantenay (100)	Large heavy root, suitable for baby food or dicing.
Danvers 126 (100)	Large heavy root, suitable for baby food or dicing, widely used. CB.
Spartan Bonus* (110)	Good color and size, suitable for baby food or soup. CB.

CAULIFLOWER

Snow Crown* (50)	Extraearly. Uniform, medium-sized head that may develop a pinkish tinge.
Snow King* (58)	Early, heat-tolerant, suitable for marketing.
Snowball Y (70)	Large, main season type.
Self-Blanche (72)	Main season type, may not require tying if weather is cool.

CHARD

Lucullus (55)	Tall plant, slender white petioles, heavily crumpled leaves.
Large White Rib (60)	Tall plant, broad smooth leaves, white petioles. Easy to wash.
Burgundy (60)	Bright red petioles, ornamental, good quality.

COLLARD

Carolina (70)–trial	Similar to Vates in plant color and cold resistance, but also resistant to downy mildew. DM.
Vates (75)	Leading commercial variety. Low, spreading growth, dark green leaves. Very hardy.
Georgia (80)	Standard variety. Tall plant, large somewhat crumpled leaves. Produces under adverse weather conditions.

CUCUMBER (slicing)

Challenger* (60)	Long-time standard, widely adapted. Heavy producer, dark green fruit. CMV, DM.

(*cont.*)

Victory* (60)	Early, gynoecious. Longer fruit than Poinsett. DM,PM,ALS,A,CMV,Sc.
Gemini* (61)	Gynoecious, productive. Shorter fruit than Marketmore. DM,PM,ALS,A,CMV, Sc.
Pacer* (63)	Deep green, uniform fruit. Productive with adequate spray program. Sc,CMV.
Sweet Slice (63)	Long fruit, productive, bitter-free. Suitable for plant sales, specialty, and roadside markets. DM,PM,CMV,ALS,Sc,A.
Saticoy* (64)	Dark green, uniform fruit, productive. DM,SMV.
Poinsett (64)	Long-time standard, dark green fruit. Suitable for spring and fall planting. DM,PM,ALS,A.
Poinsett 76 (65)	Slightly longer than Poinsett. Sc,DM, PM,ALS,A.
Marketmore 76 (67)	Improvement of Marketmore 70. Dark green fruit, somewhat longer than Poinsett. PM,DM,CMV,Sc.
Marketmore 80 (68) –trial	Bitter-free Marketmore. Suggested for trial in local markets. CMV,Sc,DM,PM.

CUCUMBER (pickling)

Bounty* (51)	Gynoecious, black spine, long fruit. DM, PM,Sc,CMV,ALS,A.
Premier* (51)	Gynoecious, white spine, widely adapted. DM,PM,Sc,CMV,ALS,A.
Early Pik* (54)	Gynoecious, white spine. CMV,Sc.
Calypso* (56)	Gynoecious, white spine, dark green fruit. ALS,DM,PM,CMV,Sc.
WIS SMR 18 (56)	Monoecious, long-time standard variety. CMV,Sc.

CUCUMBER (greenhouse)

LaReine* (60)	Gynoecious variety, parthenocarpic fruit 15 to 17 inches long, productive, bitter-free. Suitable for local markets. Requires special culture. Sc.
Gourmet* (65)	Gynoecious variety, parthenocarpic fruit 14 to 16 inches long. Suitable for local markets. Requires special culture.

EGGPLANT (large oval)

Dusky* (63)	Small fruit, widely adapted. Best for early crop only.
Black Magic* (73)	Productive, standard variety. Good size, dark color.
Classic* (76)	Long, tapered, dark glossy fruit.

EGGPLANT (specialty)

Ichiban* (60)	Long, slender fruit, purplish leaves. Prolific, suitable for plant sales and local markets.
Viserba (60)	Distinctive, long, slender Japanese type, green calyx, dark glossy fruit. Suitable for local markets.

KALE

Vates (Dwarf Blue Curled) (55)	Low growing, hardy. Attractive, finely curled, deep blue green leaves. Holds color in cold weather.
Dwarf Siberian (65)	Low spreading, broad, gray green, frilled leaves. Very cold hardy.

LETTUCE (greenhouse)

Grand Rapids (45)	Use tipburn-resistant strain.
Bibb (60)	High quality, loose semihead. Requires warmer temperatures and closer spacing than Grand Rapids.

LETTUCE (leaf)

Black Seeded Simpson (45)	Early loose-leaf type, good flavor.
Grand Rapids (45)	Tipburn-resistant, loose-leaf type.
Summer Bibb (62)	Slow bolting with thick, tender, dark green, flavorful leaves. Tipburn-resistant.
Buttercrunch (64)	Larger than Summer Bibb but similar in appearance. Tipburn-resistant.

MUSKMELON

Burpee Hybrid* (82)	Large fruit, heavy netting. Suitable for local markets. F.
Harper* (85)	Medium-large, round fruit, fine netting. Best for local markets. Cracks in wet weather. F.
Gold Star* (87)	Large fruit, netted. Widely grown for local markets.
Supermarket* (88)	Medium-large fruit, netted. Suitable for shipping. F,DM.
Saticoy* (90)	Large, firm fruit, fine netting. Suitable for local markets and shipping. A_1,F, PM,DM.
Harvest Queen (90)	Large fruit, coarse netting, thick orange flesh. Suitable for shipping. F.
Burpee Crenshaw* (90)	Very large (up to 10 pounds), oval-pointed, firm fruit, salmon flesh, no netting. Green skin turns golden when ripe. Suitable for local markets in southern Illinois.

MUSTARD

Southern Giant Curled (50)	Standard southern variety. Large, upright, bright green leaves with curled edges.
Green Wave (55)	Large, upright, moderately curled green leaves. Slow growing and long standing.

OKRA

Dwarf Green Long Pod (50)	Plants 4 feet tall. Pods 7 inches long, ribbed, dark green.
Clemson Spineless (55)	Plants 4½ feet tall. Pods 6 inches long, tapered, ribbed, medium green.
Emerald (58)	Plants 5 feet tall. Pods 8 inches long, smooth, round, dark green.

ONION (yellow)

Pronto S* (90)	First early variety, dark yellow.
Abundance* (95)	Large, for early market, stores poorly.
Rocket* (95)	Widely adapted, medium yellow, suitable for market or long storage.
Early Yellow Globe (95)	Medium to large, suitable for early market.
Spartan Banner* (107)	Large, light brown, suitable for storage. FBR.
Fiesta* (110)	Large, yellowish brown, suitable for market or short storage.
Downing Yellow Globe (112)	Large, reddish brown, suitable for storage.
Yellow Sweet Spanish (120)	Extralarge, dark yellow, late. Often grown from transplants.

ONION (red)

Ruby (105)	Deep red, large, fair for storage.
Southport Red Globe (110)	Smaller than Ruby, fair for storage.

ONION (white)

Southport White Globe (110)	Medium size, good for storage.
White Sweet Spanish (120)	Late standard, milder than Yellow Sweet Spanish.

PEPPER (bell type)

New Ace* (65)	Fruit blocky but small, suitable for early market.
Tasty* (70)	Productive, small to medium-sized fruit.
Bell Boy* (70)	Medium-sized fruit, mostly firm and blocky. TMV.
Staddon's Select (70)	Large, sometimes rough fruit, sets under adverse conditions. TMV.
Lady Bell* (72)	Productive, widely adapted, medium to large fruit. TMV.
California Wonder (75)	Standard market variety, productive over long season. TMV.
PIP (75)	Widely adapted new variety for areas where Keystone is grown. TMV.
Hybelle* (76)	New, blocky, medium-large fruit. TMV.
Yolo Wonder (78)	Standard, large, blocky fruit, productive B strain. Compact plant, earlier than L strain. TMV.
Keystone Resistant Giant (80)	Standard market variety, large, blocky fruit. TMV.
Emerald Giant (80)	Large, blocky fruit, thick walls. TMV.
Florida VR-2 (80) –trial	Large, blocky fruit. Suggested for trial. TMV, TEV, BS.

PEPPER (specialty)

Hot Portugal (64)	Large, red fruit, hot, 6 inches long, tapered.
Cubanelle (68)	Large, yellowish green fruit, sweet, 6 inches long, tapered and blunt.
Hungarian Wax (70)	Waxy yellow fruit, hot, 6 inches long, pointed.
Sweet Banana (72)	Yellow fruit, sweet, 6 inches long, pointed.
Jalapeno (75)	Green fruit, hot, 2 to 3 inches long, thick walls.
Red Cherry (80)	Small, red fruit, flattened, hot or sweet.
Red Chili (85)	Small, red fruit, hot, 2 inches long. Suitable for drying. BS.

POTATO

Norland	Early, round to oblong, red with shallow eyes. Generally used as boiling potato. Sc.
Norchip	Early, white chipper, often irregular in shape. Deep eyes that are susceptible to internal sprouting.
Superior	Early, round white with deep eyes. Good for baking. Sc.
Katahdin	Large, round white with consistently good yields. Shallow eyes and smooth white skin. V.
Kennebec	Large, long white, tends to be misshapen. Excellent for baking. LB,NN.
Pontiac	Late, round red.

PUMPKIN (small, 4 to 6 pounds)

Spookie (90)	Round, bright orange. Selected for carving jack o'lanterns. Fine texture.
Sugar Pie (Early Sweet Sugar) (90)	Round, flattened, somewhat ribbed, deep orange. Fine texture.
Small Sugar (105)	Round, flattened, somewhat ribbed, deep orange. Fine texture.

PUMPKIN (intermediate, 8 to 15 pounds)

Spirit* (110)	Bright orange Halloween type on semibush plant.
Young's Beauty (112)	Round, bright orange, slightly ribbed. For carving jack o'lanterns. Medium texture.

PUMPKIN (large, 15 to 25 pounds)

Jackpot* (100)	Round Halloween pumpkin on semivining plant. Medium texture.
Connecticut Field (Big Tom) (115)	Standard Halloween pumpkin. Flattened globe shape, slightly ribbed, bright orange. Coarse texture.
Howden Field (115)	Deeper round shape than Connecticut Field. Excellent for jack o'lanterns. Coarse texture.

SPINACH (fresh market)

Virginia Savoy (39)	Erect, dark green leaves. Suitable for fall crop. F,CMV.
Melody* (43)	Moderately curled leaves. Suitable for spring or fall crop. DM,CMV.
Winter Bloomsdale (45)	Slow bolting. Dark green, heavily curled leaves. Suitable for spring or fall crop. DM,CMV.
Long Standing Bloomsdale (48)	Slow bolting. Thick, heavily curled leaves.

SQUASH (summer)

Zucchini Hybrid* (47)	Earliest dark green zucchini.
Zucchini Elite* (48)	Dark green zucchini with slim, elongated fruit.
Golden Girl* (50)	Bright yellow, prolific.
Seneca Prolific* (51)	Creamy yellow, straight, tapered fruit.
Seneca Butterbar* (51)	Attractive, butter yellow, straight, tapered fruit.
Early Prolific Straightneck (52)	Pale yellow, club-shaped fruit.

SQUASH (winter)

Table Ace (78)	Semivining acorn type. Uniform dark green fruit of excellent quality.
Table King (80)	Bush vine, acorn type. Fruit somewhat lighter in color than Table Ace.
Table Queen (85)	Standard acorn type for market and storage.
Hybrid Butternut* (85)	Semivining butternut type. Smaller and earlier than other butternuts.
Hercules (90)	Vining butternut type. Large, thick, blocky fruit with rich, orange flesh.
Waltham Butternut (95)	Vining butternut type. Very uniform fruit, solid straight neck, small seed cavity.
Turk's Turban (100)	Brightly colored, turban-shaped fruit. Orange, red, cream, white, and green ornamental for local and roadside sales.
Buttercup (100)	Vining plant, green turban-shaped fruit with orange flesh. High quality, fine texture, 4 to 5 pounds.
Kinred (100)	Vining plant, red turban-shaped fruit with yellow flesh.
Delicious, Golden (105)	Vining plant, medium-sized, heart-shaped, smooth fruit, reddish orange skin. Medium-textured, high quality flesh. Excellent keeper.
NK 530* (105)	Vining plant, medium to large, heart-shaped fruit, reddish orange skin, medium-grained flesh.
NK 580* (105)	Vining plant, medium to large, heart-shaped fruit, reddish orange skin, medium-grained flesh.
Hubbard (100-115)	Vining plant, large fruit, coarse-warted rind, orange red, dark green, and blue gray skin. Good keeper.
Vegetable Spaghetti (110)	Vining plant, oblong, yellow fruit, 3 to 4 pounds. Novelty for roadside and local sales.
Big Max (120)	Vining plant, extralarge, heavy, bright reddish orange fruit. Sold for seasonal decoration, resembles a pumpkin.

SWEET CORN (yellow)

Spring Gold* (66)	First early variety with cold tolerance, 7-inch ear. MDM.
Aztec* (68)	Good quality for fresh markets, 7½-inch ear. MDM,SW,Sm.
Earliking* (69)	Dependable early corn, 7-inch ear.
Sundance (69)	Standard early market variety in Illinois, 7½-inch ear. High yielder, excellent tip cover. MDM.
Earlibelle* (71)	Good yielder, ear somewhat larger than Sundance. MDM,SW,R.
Northern Belle* (74)	Second early variety, nearly 8-inch ear. SW.
Bellegold* (75)	Second early variety, 8-inch ear of Bellringer type. MDM,SW.
Reliance* (76) –trial	Early midseason variety, suitable for processing and fresh marketing, 8-inch ear. NCLB.
Bellringer* (77)	High yielder, excellent tip cover, 7½-inch ear. MDM,SW,Sm.
Cherokee* (79)	Vigorous, developed for mechanical harvesting, 8-inch ear. MDM,SW,NCLB, Sm,R.
Gold Cup* (80)	Standard main season variety, good tip cover, 7½-inch ear. SW,Sm,R.
Merit* (80)	Good yielder, attractive 8-inch ear. MDM,SW,Sm.
Seneca Scout* (80) –trial	High yielder, suitable for mechanical harvesting, attractive 8-inch ear. SW.
Jubilee* (81)	Good quality, main season variety for processing and fresh marketing. Nearly 8-inch ear, widely adapted. R.
Bonanza* (82) –trial	Very large, 8½-inch ear, high yielder for late season. SW.
NK 199* (83)	Standard for processing, large-diameter, 7½-inch ear. NCLB,R.
Seneca Chief* (85)	Popular standard of quality in its season. SW.
Style Pak* (85)	Late main season variety, large 8½-inch ear, developed for processing and marketing. SW,NCLB,R.
Golden Queen* (88)	Popular, high quality late variety, good husk cover, 8-inch ear. SW,NCLB.

SWEET CORN (white)

Quicksilver* (75)	Vigorous, early white variety, high yielder, 7-inch ear. SW.
Comet* (80)	High yielding, main season, white variety, suitable for mechanical harvesting, 8-inch ear. SW,NCLB,Sm.
Earliqueen* (80)	Attractive, nearly 8-inch ear, suitable for main season markets.
Silver Queen* (88)	Quality standard for marketing and freezing, tender kernels, 8-inch ear. Smaller ear under adverse conditions, susceptible to smut. SW,NCLB.
Country Gentlemen (90)	Vigorous, good yielder. Good husk, distinctive "Shoe Peg" type.

SWEET CORN (bicolor)

Harmony* (75)	Best early bicolor, but short ear and may blank under adverse conditions.
Honey-n-Frost* (82)–trial	Attractive, tender, high quality kernels, 7½- to 8-inch ear.

Sweet Sal* (86)	Excellent quality and husk protection, one of best bicolors, 8-inch ear. SW.
Sweet Sue* (88)	Attractive 8½-inch ear of excellent quality. SW,Sm.
Bi-Queen* (88)	Best late bicolor, full 8-inch ear. SW, NCLB.

SWEET CORN (high sugar)

Early Xtra Sweet (75)	Best early extra-sweet corn, 7-inch ear, germinates poorly in cold soil.
Honeycomb* (80) –trial	Best main season synergistic sweet corn, larger ear and better husk cover than Sugar Loaf. NCLB,R.
Sugar Time* (82) –trial	Synergistic sweet corn, attractive 8-inch ear, acceptable husk cover, tender kernels.
Sugar Loaf* (83) –trial	Popular synergistic sweet corn, high yielder. NCLB.
Sucro* (83)	Synergistic sweet corn, large 8½-inch ear, good husk cover, somewhat tough kernels.
Illini Xtra Sweet (85)	Extra-sweet corn, larger ear than Early Xtra Sweet but inferior husk protection. Germinates poorly in cold soil.
Candyman* (85)	Good quality extra-sweet corn, good husk cover, nearly 8-inch ear.
Florida Sta Sweet* (87)	Best extra-sweet corn, widely adapted, 8-inch ear. Germinates poorly in cold soil. NCLB.
Symphony* (90) –trial	New bicolor, synergistic sweet corn, excellent quality, picks hard.

SWEET POTATO

Jewel (120)	Orange flesh, large, stores well.
Nugget (125)	Tan skin, semidry, orange flesh. High quality, stores well. F,Br,IC,N.
Centennial (150)	Orange skin, moist, good quality, deep orange flesh. Medium to large, good yielder, stores well.

TOMATO (red)

Early Girl* (55)	Indeterminate plant suitable for staking and pruning. Adapted to northern Illinois only. Fruit small unless pruned. V.
Springset* (65)	Determinate, open plant, medium-sized fruit. Best adapted to northern Illinois. V,F.
Spring Giant* (68)	Determinate, vigorous plant suitable for caging, medium-sized fruit. All-America Selection. V,F.
Pik-red* (70)	Determinate, compact vine, large, very firm fruit. V,F.
Jet Star* (72)	Indeterminate plant suitable for staking, firm, crack-resistant fruit. Widely grown for fresh market, tolerant to early blight. V,F.
Super Fantastic* (72)	Vigorous, indeterminate vine suitable for staking and pruning. Large, firm fruit, suitable for local sales and market gardens. V,F,N.
Royal Flush* (72) –trial	Vigorous, determinate, compact vine, medium-large, firm fruit. V,F,N.
Burpee VF* (72)	Indeterminate vine suitable for staking, fruit medium in size and firmness. V,F.
Campbell 1327 (75)	Determinate, large plant with good cover, medium-sized, slightly flattened, crack-resistant fruit. Suitable for early markets. V,F.
Heinz 1350 (75)	Determinate, compact vine, medium-sized, crack-resistant fruit. Suitable for market gardens. V,F.
Show Me (75) –trial	Vigorous, indeterminate vine, medium-sized fruit, very firm, crack-resistant. Developed at University of Missouri and well adapted to southern Illinois. V,F.
Bigset* (78)–trial	Determinate, large plant, medium-large, firm fruit. V,F,N.
Floramerica* (78) –trial	Determinate, vigorous plant, large fruit, All-America Selection. Resistant to several disorders and foliar diseases. A,V, F,N.
Mainpak* (80)	Vigorous, determinate vine, good cover, medium-large, firm fruit. V,F.
Supersonic* (80)	Indeterminate, large vine suitable for staking. Popular for local and garden plant sales. V,F.
Better Boy* (80)	Indeterminate, large vine suitable for staking, large fruit. Popular for local and garden plant sales. V,F,N.
Wonder Boy* (80)	Indeterminate, large vine suitable for staking, large, smooth fruit. Suitable for local markets and garden plant sales. V,F,N.

TOMATO (yellow)

Jubilee (75)	Indeterminate vine, large, deep-globed fruit, yellow skin and orange flesh. Productive.
Golden Boy* (80)	Indeterminate vine, large fruit, smooth, yellow skin and gold flesh.
Sunray (83)	Indeterminate vine, large, firm fruit, smooth, yellowish orange skin. F.

TOMATO (pink)

Pink Panther* (74)	Indeterminate vine suitable for staking or caging, medium-large, smooth, crack-resistant fruit. F.
Traveler 76 (78)	Indeterminate vine suitable for staking and pruning, large, smooth, crack-resistant fruit. Productive in southern Illinois. F.
Pink Wrap	Indeterminate vine suitable for staking, large, crack-resistant fruit.

TOMATO (greenhouse, indeterminate)

Michigan-Ohio Hybrid*	Standard red variety. Vigorous plant, medium-small, uniform fruit, very susceptible to leaf mold. F.
Ohio MR-13*	Standard pink variety, requires large amounts of fertilizer to maintain vine growth. F,TMV.

(cont.)

Ohio WR-25*	Vigorous vine, bright pink, medium-large, crack-resistant fruit. F.
Jumbo*–trial	New red hybrid from Europe. Vigorous vine, large, firm, crack-resistant fruit. V,F.
Tropic	Standard red variety grown in plastic hydroponic houses, medium-large fruit. Vigorous, resistant to several foliar diseases. V,F.

TURNIP

Just Right* (40)	Uniform hybrid, white roots, suitable for fall crop.
Purple Top White Globe (58)	Widely used, smooth, globe-shaped roots.

WATERMELON

Yellow Baby* (80)	Small, round, light green fruit with dark stripes. Yellow, crisp flesh, excellent quality for early market sales. Suggested pollinator for seedless melons.
Seedless Hybrid 313* (90)	Oval, medium green fruit with dark stripes, 12 to 18 pounds. Crisp flesh, high quality for local sales. Requires pollinator. A.
Triple Sweet Hybrid* (90)	Seedless, round fruit with light green stripes, 10 to 15 pounds. Crisp flesh, high quality for local sales. Requires pollinator.
Charleston Gray (95)	Oblong, light green fruit, thin, tough rind, 20 to 25 pounds. F,A.
Crimson Sweet (95)	Oval, blocky, light green fruit with dark stripes, 20 to 25 pounds. Fine, sweet quality. F,A.
Iopride (95)	Oblong, blocky, dark green fruit with stripes, 15 to 20 pounds. Fine, sweet quality. F.
Jubilee (100)	Oblong, light green fruit with dark stripes, 20 to 30 pounds. Tough rind for shipping. F,A.
Allsweet (100)	Oblong yellow green fruit with dark green stripes, 30 to 40 pounds. Small seeds, long shelf life. F,A.

This circular was prepared by J. W. Courter and J. M. Gerber, Extension Specialists in Vegetable Crops, and by B. J. Jacobsen, Extension Specialist in Plant Pathology, University of Illinois at Urbana-Champaign.

1982 Disease Management Guide for Commercial Vegetable Growers

THE SUCCESSFUL CONTROL OF VEGETABLE DISEASES requires the use on an integrated basis of resistant varieties, disease-certification programs, crop rotations, balanced soil fertility, weed and insect control, proper crop culture; also, the use of fungicides, bactericides, or nematicides. Economical disease control requires an overall management system for the entire farm. Recordkeeping is necessary concerning which crops have been planted, what problems occurred, and what pesticides were used.

This circular presents information updated annually about disease management for vegetables. The information given should be used in conjunction with the current versions of Circular 897, *Insect Pest Management Guide — Commercial Vegetable Crops and Greenhouse Vegetables,* and Circular 907, *Weed Management Guide for Commercial Vegetable Growers.* Those circulars are also revised each year. Circular 1174, *Vegetable Varieties for Commercial Market Growers,* contains information on disease resistance.

Since many disease problems originate with seeds or transplants, growers should follow the recommendations about seed treatments. Otherwise, be sure to obtain planting material that is certified as being free of disease.

Vegetable fungicide tolerances and intervals approved by the Food and Drug Administration and the Environmental Protection Agency as of October 1, 1981, are presented in this publication. The tables on fungicide uses and label information give the tolerances in parts per million (ppm) and the number of days between the last application at the normal rate and the harvest *or* they give the date for a last application that will keep residues within the tolerances set by the FDA.

The listing of a chemical for a crop does not necessarily constitute a recommendation for the control of a disease on that crop by the Illinois Cooperative Extension Service or Agricultural Experiment Station. Specific recommendations are given in the table called "Condensed Recommendations . . ."

In some instances, a tolerance (ppm) has been set but a definite interval has not been established. The absence of an interval does not mean necessarily that the fungicide may not be used on that crop. The use of the fungicide would require such restrictions as "do not apply after first blooms appear" or "do not apply after edible parts form."

In a few cases, the interval and dosage have been established but the allowable ppm residue has not been determined. Here again, this does not mean that the fungicide may not be used on that crop. It does mean, however, that until one is established the tolerance must be considered as zero. Zero tolerances are reviewed each year. Some are cancelled as the manufacturer supplies the EPA with additional data.

Growers must follow a program of disease control that will assure the production of vegetables with no excessive fungicide residues. Vegetables marketed with residues exceeding the FDA tolerances may be injurious to consumers, may be confiscated, and may cause the grower to be brought to court.

Growers have nothing to fear from the law as long as they use fungicides and other pesticides according to the current label and only on the crops specified, in the amounts specified, and at the times specified. The safe grower keeps a record of the products and trade names used, the percentage of active ingredients, dilutions, rates of application per acre, and dates of application. The record sheet provided on the last page provides a convenient place to keep such information.

This circular is revised each year. Be sure you are using the most up-to-date copy.

Prepared by Barry Jacobsen, M. C. Shurtleff, and Molly Niedbalski Cline, Department of Plant Pathology

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE

Urbana, Illinois Circular 1184 (revised annually) November, 1981

FUNGICIDE USES AND RESIDUE INFORMATION FOR VEGETABLES APPROVED BY THE EPA, OCTOBER 1, 1981[a, b, c]

Crop	Benlate,[d] 0.2-50 ppm	Captan (D) 2-100 ppm	Bravo, 0.1-15 ppm	Difolatan, 0.1-15 ppm	Dyrene, 0.1-10 ppm	maneb, 4-45 ppm maneb with zinc salt	mancozeb[e] 0.1-15 ppm	zineb, 4-25 ppm
Asparagus	..	root dip	..	..	..	A[f]	A	A
Beans (dry, lima, snap)	(2-beans, 50-forage), 14, 28 on lima, B	pp, 0	(5-snap), 7, B(snap only)	..	..	(10), 0, 4 on limas or snap	..	(7), 7
Beet, garden	..	(2-root, 100-greens),0, pp	..	..	..	..	..	(7-roots); (25-tops), 7
Broccoli	..	pp	0	..	..	(10), 3, or trim and wash, 0	..	(7), 7
Brussels sprouts	..	pp	0	..	..	..	..	(7), 7
Cabbage	..	pp	0	..	..	(10), 7	..	(7), 7
Cantaloupe (muskmelon)	0	0, ph,[f] pp	0	0	0	(4), 5	(4-edible parts), 5	(4), 5
Carrot	..	0	0	..	..	0	(2), 7, B (tops)	(7), 7 (tops)
Cauliflower	..	pp	0	..	..	0	..	(7), 7
Celery	(3), 7	0, pb	(15), 7	..	0	(5), strip and wash, 14	0	(5), 14
Chinese cabbage	..	..	..	..	..	..	..	(25), 7
Corn, sweet and pop	..	(2-kernels plus cob), 10, B, pp	(1-kernels plus cob), 14, B[g]	..	..	0, B, C	(0.5-cob and kernels, 15-fodder and forage), 7	0, B, C
Cucumber	0	0, ph, pp	0	0	0	(4), 5	(4), 7	(4), 5
Eggplant	..	0, ph, pb	..	..	..	0	..	0
Endive, escaroie	..	..	..	..	..	(10), 10, and wash	..	(10), 10
Fennel	..	..	..	..	..	..	(10), 7	..
Kale, collard	..	(2-greens), pp	..	..	..	(10), 10, and wash	..	(25-collard), 7; (10-kale), 10
Kohlrabi	..	pp	..	..	..	0	..	(7), halfgrown
Lettuce	..	0	..	..	..	10, strip and wash	..	(10), 10
Mustard greens	..	pp	..	..	..	(10), 10, and wash	..	(10), 10
Onion	..	(50-green, 25-dry),0, ph	(5-green), 14; (0.5-dry), 7	0	0	0	(0.5-dry), 7, D	(7), 7
Peas	..	(2-dry and succulent), pp	..	..	..	..	..	(7), 10
Pepper	..	0, pb, pp	..	..	..	0	..	0
Potato, Irish[f]	..	0, ph	0	0	0	0, C	0	0 and seed, C, pp
Pumpkin	0	0, pp	0	..	0	0	..	0
Radish	..	..	..	..	..	..	..	0
Rhubarb (greenhouse)	..	0	..	..	..	0	..	..
Spinach	..	0, pp	..	..	..	(10), 10, and wash	..	(10), 10
Squash	0	0, pp	0	..	0	(4), 5	(4), 5	(4), 5
Sugar beet[f]	(0.2-roots, 15-tops), 21	0	..	..	..	(45-tops), 10, B, C; 14, no feeding restrictions	(2-roots, 65-tops), B, 14	..
Swiss chard	..	0	..	..	..	..	..	(25), 7
Tomato	0	0, pp	0	0[h]	0	(4), 5, F	5	(4), 5
Turnip, rutabaga	..	(2-greens and roots), pp	..	..	..	(10-tops, 7-roots), 7, and wash	..	(7-roots and tops), 7 (tops)
Watermelon	0	0, pp	0	0	0	(4), 5	(4-edible parts), 5	(4), 5

[a] No tolerances have been set for these fungicides on dill, horseradish, okra, parsley, and parsnip. Tolerance information is given in the table in parts per million within parentheses.

[b] The following abbreviations are used:
- A = Postharvest application to ferns only or to young plantings that will not be harvested.
- B = Do not feed treated tops or forage to livestock.
- C = Do not use treated seed or seed pieces for feed or food.
- D = Do not apply to exposed bulbs.
- E = Do not apply after fruit buds form.
- F = To avoid damage, do not use on tender young plants.
- pb = Plant bed treatment.
- ph = Postharvest spray or dip.
- pp = Preplant soil treatment.

[c] Numbers in table that are not in parentheses indicate number of days between last application and harvest; 0 = up to harvest.

[d] Do not apply Benlate alone; always use in combination with mancozeb or other labelled protective fungicide such as Captan, Bravo, Dyrene, or maneb. Do not mix with Mertect or Topsin-M.

[e] Mancozeb is sold as Dithane M-45 and Manzate 200.

[f] Tolerances are not needed for pesticides applied only to the foliage and not translocated to the tubers or roots.

[g] Do not apply if the crop will be used for processing.

[h] Machine harvest only.

LABEL INFORMATION ON FUNGICIDES OF LESS GENERAL USE

Fungicide (tolerance)	Crops and use restrictions
Botran (5-20 ppm)	Beans (snap) — white mold, 2 days to harvest. Do not feed forage to livestock. Greenhouse tomato — to harvest. Do not drench seedlings or newly set transplants. Carrot — postharvest dip or spray, see label. Garlic, onion — soil application before seeding or spray to soil around sets or bulbs. *Do not plant spinach* as a followup crop in treated soil. Leaf lettuce (greenhouse) — 14 days[a] (do not apply to wilted plants or seedlings). Head lettuce — 14 days. Celery — 7 days. Cucumber (greenhouse) — see label. Rhubarb (greenhouse) — 3 days. Potato — 14 days (do *not* feed to livestock). Sweet potato — root dip and plant bed treatment. Note: Do not plant tomatoes as followup in treated soil. Don't use spent roots for food or feed. Postharvest spray or dip as directed. Tomato (greenhouse) — 3 days.
chloroneb (Demosan)	Beans — seedling diseases. Seed treatment or in-furrow spray at planting.
Copper fungicides[b] tribasic copper sulfate (Kobasic, Triangle, Tri-basic Copper Sulfate, etc.)	Bean, beet, broccoli, Brussels sprouts, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, potato, pumpkin, radish, spinach, squash, tomato, watermelon.
copper sulfate (many)	Bean, broccoli, cabbage, cantaloupe, cassaba melon, cauliflower, celery, cucumber, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, watermelon.
copper resinate (Citcop 4E, Cop-O-Cide, Emulsifiable Liquid Copper Fungicide)	Bean, broccoli, cantaloupe, cauliflower, chinese cabbage, carrot, celery, cucumber, honeydew melon, lettuce, muskmelon, onion, pepper, pumpkin, squash, tomato, turnip, watermelon.
copper ammonium carbonate (Copper-Count N)	Bean, cabbage, carrot, crenshaw melon, celery, cantaloupe, cassaba melon, cucumber, honeydew melon, lettuce, muskmelon, pepper, Persian melon, potato, squash, tomato, watermelon.
copper hydroxide (Kocide 101 and 404)	Bean, broccoli, Brussels sprouts, cabbage, cantaloupe, carrot, celery, cucumber, honeydew melon, muskmelon, pepper, potato, pumpkin, squash, tomato, watermelon.
copper oxychloride sulfate (COCS, Copro 50 and 53)	Bean, beet, broccoli, Brussels sprouts, cabbage, cantaloupe, carrot, cassaba melon, cauliflower, celery, crenshaw melon, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, Persian melon, potato, pumpkin, spinach, squash, tomato, watermelon.
Bordeaux mixture (Acme Bordeaux mixture, Pattersons Bordeaux mixture, Bor-Dox, Ortho Bordo mixture, etc.)	Asparagus, beans, beets, broccoli, Brussels sprouts, cabbage, carrot, cassaba melon, celery, collards, crenshaw melon, honeydew melon, horseradish, kale, mustard, pepper, rape, rutabaga, spinach, cress, cucumber, eggplant, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, turnip, watermelon.

Fungicide (tolerance)	Crops and use restrictions
fenaminosulf (Lesan)	Cleared *only* for seed-treatment use on beans, beets, corn, cucumbers, peas, spinach, sugar beets. Do not use treated seed for food, feed, or oil. Slurry seed treatment for planting in light soils or soils high in clay or organic matter.
dinocap (Karathane)	Cantaloupe (muskmelon), cucumber, honeydew melon, pumpkin, squash, watermelon — 7 days. For control of powdery mildew only.
etridiazol (Terrazole, Truban)	Seed treatment: Beans, peas, sugar beets.
polyethylene polymer (Polyram) (0 ppm)	Potato, sugar beet — no time limitations. Celery — 14 days. Cantaloupe, cucumber, tomato — 5 days. Do *not* feed sugar beet tops to meat or dairy animals. Celery — strip, trim, and wash — 14 days. Postharvest application to asparagus ferns.
PCNB (Terraclor, Brassicol, Fungiclor) (0.1 ppm)	Beans — base of plants *before* blossoming, soil and seed treatment at planting, or foliar spray. Do *not* feed treated Bean vines to livestock. Do *not* apply after first bloom. Broccoli, Brussels sprouts, cabbage, cauliflower — transplant solution (¾ pint per plant) or row treatment before transplanting. Pepper, potato, tomato — soil treatment at or before planting. Tomato (greenhouse) — transplant solution (½ pt. of 0.2% per plant). Garlic — soil and seed treatment at planting.
streptomycin (0.25 ppm)	Celery, pepper, tomato — plant beds only (200 ppm spray); Potato — seedpiece treatment only (100 ppm dip or dust). Soak cut seed pieces less than 30 min. Beans — seed treatment for halo blight control. Do not use treated seed for food or feed.
sulfur, lime, and lime-sulfur	Exempt when used with good agricultural practices. See label.
thiabendazole (Mertect) (0.02-0.1 ppm)	Sweet potato — "seed" root treatment. Do not use treated pieces for food or feed. Potato — "seed" tubers only (1,500 ppm-20 sec. dip). Storage rot control.
thiophanate methyl (Topsin-M)	Beans — white mold and gray mold. Snap or dry beans, 14 days. Lima, 28 days. Celery — early and late blight, 7 days.
thiram, TMTD (0.5-7 ppm)	Onion — Furrow treatment. Celery — 7 days (strip, trim, and wash). Sweet potato — preplant root dip. Tomato — 0 days, for leaf spots and fruit rots. Seed treatment: Beans, beets, broccoli, Brussels sprouts, cabbage, cantaloupe, carrot, cauliflower, collard, corn, cucumber, eggplant, endive, kale, kohlrabi, lettuce, okra, onion (bulb, seed, and set), peas, pepper, pumpkin, radish, spinach, squash, swiss chard, tomato, turnip, watermelon. WARNING: Do not use treated seed for food, feed, or oil — 7 days.
triphenyltin (Du-Ter)	Carrot — Alternaria leaf spot and late blight — 14 days. Potato — early and late blight. May be applied through irrigation systems (solid set or center pivot only).

[a] Number of days between last application and harvest.
[b] There are many other copper materials, but these are most widely available and labeled for use on vegetable crops. Exempt from tolerance if used with good agricultural practices; not exempt if used at the time of harvest or after harvest. See label.

CONDENSED RECOMMENDATIONS ON DISEASE MANAGEMENT FOR DISEASES OF COMMERCIAL VEGETABLE CROPS FOR 1982

Vegetable	Disease management practices
Asparagus	
Crown or root rots, seedling blights, and wilt	No resistant varieties are available for control of these diseases. Treating the crowns with captan or mancozeb may aid in control. These diseases are best managed by good asparagus culture. Provide optimal soil fertility, and weed, insect and rust control. Avoid excessive cutting.
Rust, other leaf and branchlet blights	Grow rust-resistant varieties. Apply zineb, maneb, mancozeb, or Polyram to nonharvested fields up to August 15 and to harvested fields after harvest only. Applications should be made on 7- to 10-day intervals.
Beans (snap, dry, wax, and lima)	
Most diseases	When possible, use rotations of 2-3 years between bean crops.
Seed decay, damping-off, seed-borne stem blights, and root rots	Plant only western-grown, certified seed in a seed bed that is warm (60°-65° F.) and well-prepared. Seed treatment with thiram, captan, Terrazole, or chloroneb plus insecticide is suggested. In-furrow sprays of chloroneb may be helpful for early season root-rot control.
Root rots	Maintain optimal soil fertility. Utilize crop rotations of 2-3 years.
Bacterial blights	Plant only western-grown, certified seed. Utilize crop rotations of 2 to 3 years. Avoid cultivating when beans are wet. Streptomycin may be added to seed treatment fungicide/insecticide. Field applications of 2-3 pounds of fixed copper per acre will provide good control of brown spot and halo blight, only moderate control of common or fuscous blight.
Downy mildew and syringe blight (brown spot) on lima beans	Make early and weekly applications of fixed copper. Eliminate lilac and wild cherry from field borders.
Rust, anthracnose, and other fungal leaf, pod, and stem diseases	Utilize crop rotations of 2-3 years. Apply maneb, zineb, or Bravo at 7- to 10-day intervals. Rust-resistant varieties are available for some types of beans.
White mold, gray mold	Apply Benlate, Botran, or Topsin-M first at initial to 25 percent bloom and again at full bloom. Botran may be used on snap beans only.
Virus diseases	Plant varieties with resistance to bean common mosaic, NY15 strain of common mosaic, and bean yellow mosaic.
Soybean cyst nematode	Rotate 2-3 years with corn, small grains, alfalfa, red clover, or other nonhost crop. Do not include soybeans in the rotation.
Beets (garden and sugar), Swiss chard	
Seed rot, damping-off, and seed-borne leaf spot	Sow in a well-prepared seed bed. Treat seed with captan or thiram. Make sure boron levels are adequate.
Cercospora leaf spot	Apply zineb or fixed copper weekly at the first sign of disease.
Crucifer crops (broccoli, Brussels sprouts, cauliflower, cabbage, chinese cabbage, collards, kale, kohlrabi, mustard, radish, rutabaga)	
Seed rot, damping-off, black rot, blackleg	Sow only western-grown, hot water-treated seed. Seed also should be treated with thiram or captan. Place seed beds where no crucifer has grown for 4 years or more and where water will not drain from fields recently planted to crucifers.
Wirestem (*Rhizoctonia*)	Incorporate PCNB-captan in upper 3 inches of soil before planting or drench after planting.
Clubroot	Apply PCNB (Terraclor 75) in transplant water.
Black rot and blackleg	Use a crop rotation of 3-4 years or more. Use only hot water-treated seed. Use care in the selection of plant bed sites. Be sure no drainage occurs to seed bed from old plantings. Control wild mustard and other cruciferous weeds. Purchase only certified, disease-free transplants. Do not dip transplants before planting. Sprays of fixed copper may help control black rot. Bravo applied to control downy mildew may also help control blackleg. Some cabbage varieties resistant to black rot are available. Losses are generally lower where direct seeding is used.
Downy mildew, Alternaria leaf spot, and other fungal leaf diseases	Apply maneb, zineb, or Bravo on weekly intervals. Start applications in seed bed or when plants are young.
Tipburn	Plant resistant varieties.
Fusarium yellows	Plant yellows-resistant varieties.
Radish black root	Plant resistant varieties.
Carrots, Parsnips	
Seed rot, damping-off, Cercospora leaf spot, Alternaria leaf blight	Treat seed with captan or thiram. Apply maneb, mancozeb, zineb, or Bravo on 7-10 day interval.
Aster yellows	Use insecticides to control leafhoppers that transmit the mycoplasma. Excellent early season leafhopper control is essential. Control must occur *before* leafhoppers feed.
Root-knot nematode	Fumigate mineral soils with D-D, Telone, EDB, or Vorlex. Do not use EDB where onions will be planted within 3 years, *or* practice a 3-year rotation with corn or some other nonhost crop with which broadleaf weed hosts will be controlled.
Parsnip canker	Spray with fixed copper at a 10-day interval in late season (August) until the tops die. Ridge soil over the shoulders.
Celery, Parsley	
Seed rot, damping-off, seed-borne leaf blights	Treat plant seed with hot water, then captan or thiram. If damping-off starts, spray 2-3 times, 5-7 days apart with zineb. Seed 2-3 years old is free of late blight.

CONDENSED RECOMMENDATIONS ON DISEASE MANAGEMENT (continued)

Vegetable	Disease management practices
Leaf blights and spots	Spray maneb, zineb, Benlate, Topsin-M, Dyrene, Bravo, or mancozeb at 7-10 day intervals.
Aster yellows and Root-knot nematode	(See the section on Carrots and Parsnips)
Corn (sweet and pop)	
Seed rot, seedling blights, seed-borne diseases	Plant seed treated with captan, thiram, or Vitavax-thiram and insecticide.
Goss' bacterial wilt	Use 2 to 3 year crop rotations when using susceptible corn (dent or sweet) varieties.
Stewart's disease	Control flea beetles with insecticide, or plant tolerant hybrids.
Smut	Plant tolerant hybrids.
Maize dwarf mosaic, Wheat streak mosaic	Control Johnsongrass and volunteer wheat. Plant wheat after the fly-free date. Some hybrids tolerate maize dwarf better than others, but no hybrids are highly resistant.
Helminthosporium leaf blights, anthracnose leaf blight	Spray mancozeb, Polyram, or Bravo when disease first appears. Crop rotation and clean tillage will help reduce disease risk.
Rust	Spray the same as with zineb (see above).
Vine Crops (cucumbers, muskmelons (cantaloupe), pumpkins, squash, and watermelons)	
General	Use a crop rotation of 3-4 years. Grow resistant varieties whenever possible.
Seed rot, damping-off, seed-borne diseases	Plant only certified, western-grown seed treated with captan or thiram. Damping-off can be treated with a captan drench.
Bacterial wilt	Provide season-long control of striped and spotted cucumber beetles. Start as the plants emerge.
Anthracnose, scab, blossom blights, gummy stem blight, or black rot	Grow resistant varieties whenever possible. Spray weekly with maneb, zineb, Bravo, Dyrene, Difolatan, or Benlate.
Downy mildew, Alternaria leaf blight	Grow resistant varieties whenever possible. Maintain ample but *not* excessive nitrogen fertility. Apply maneb, zineb, mancozeb, Dyrene, Bravo, or Difolatan on a weekly schedule.
Fruit spots and rots	Maintain fungicide schedule as for anthracnose through the season. Avoid harvest injuries.
Fusarium wilt	Grow resistant varieties.
Angular leaf spot	Apply fixed copper sprays in combination with zineb, maneb, or mancozeb. Start applications early in the season. Practice crop rotations of 3-4 years. Resistant cucumber varieties are available.
Powdery mildew	Apply Karathane WD at the first sign of disease and again 10 days later. Where Benlate or Bravo are applied to control other diseases, mildew will be controlled well. Plant resistant varieties where possible.
Mosaics	Control aphids and beetles in the field. Control broadleaf weeds around field borders. Plant only mosaic-resistant cucumbers.
Root-knot nematode	Fumigate with Vapam or Vorlex in the fall before planting.
Eggplant	
Seed rot, damping-off, seed-borne diseases	Plant hot water-treated seed when possible. Treat the seed with captan or thiram. Damping-off can be controlled with a captan drench.
Phomopsis blight, Alternaria leaf spot, Cercospora leaf spot, and anthracnose	Spray plants weekly with maneb, zineb, or captan at first sign of disease or when first fruits are half sized.
Verticillium wilt, nematodes	Fumigate the soil with Vapam, Vorlex, or methyl bromide plus chloropicrin.
Horseradish	
Leaf spots	Apply fixed-copper fungicides. Start when conditions are wet or dews are heavy. Continue until a killing frost occurs.
Brittleroot	Plant clean sets. Control leafhoppers.
Verticillium wilt	Fumigate the soil before planting with Telone C.
Lettuce, Endive	
Seed rot, damping-off, Gray mold	Treat seed with captan. In the field or seed bed, work Botran into the soil before planting and spray Botran after thinning or transplanting and again as necessary. Ferbam or zineb can be used as drenches to control damping-off.
Aster yellows	Control leafhoppers throughout the season. Early season control is most important.
Rhizoctonia bottom rot, Sclerotinia drop	Plant on beds and deep plow when possible. Botran applications as previously described may help.
Gray mold, white rust, downy mildew	Apply ferbam, maneb, or zineb at 5- to 7-day intervals.
Okra	
Seed rot, damping-off	Treat seed with captan or thiram.
Fusarium wilt or Verticillium wilt	Fumigate soil with Vorlex, Vapam, or methyl bromide plus chloropicrin.
Onions, garlic, leek, chives	
Smut, seed rot, damping-off	Treat the seed with captan or thiram. Use Methocel sticker to pellet the fungicide with seed. Use 1 pound of active ingredient to 20 pounds of seed for set onions; 6 pounds of active ingredient to 8 pounds of seed for bulb onions.

CONDENSED RECOMMENDATIONS ON DISEASE MANAGEMENT (continued)

Vegetable	Disease management practices
Blast, downy mildew, Alternaria purple blotch, Botrytis neck rot	Apply maneb, zineb, mancozeb, Difolatan, Dyrene, or Bravo on a weekly schedule. Begin spraying with first ozone alert. Continue until harvest. Bravo has given superior control in research trials.
Bulb and stem nematode, Root-knot nematode	Fumigate with Telone or DD.
Fusarium basal rot	Avoid heavily infested fields. Grow resistant varieties.
Storage decays	Maintain excellent control of leaf diseases in the field. Maintain dry storage conditions.
Yellow dwarf mosaic	Control aphids. Keep old and new plantings as far apart as possible.
Peas	
Seedpiece decay, seed-borne seed-borne diseases	Plant western-grown seed treated with captan, thiram, fenaminosulf, or zineb plus insecticide. Graphite at 1 ounce per bushel may be added to reduce friction in the drill.
Root rot	Index production fields. Avoid planting in fields with an index of 75 or higher. In fields with a lower root rot index, dinoseb (Premerge 3) or trifluralin applied preplant incorporated will provide good to excellent control.
Fusarium wilt, near wilt, and virus diseases	Grow resistant varieties.
Powdery mildew	Apply lime-sulfur dust (4:6 ratio) at 30 pounds per acre when mildew first appears and temperatures are less than 80° F. Two applications a week apart will provide good control.
Fungal leaf spots and blights	Apply zineb weekly when necessary.
Peppers	
Seed rot, damping-off, and seed-borne diseases	Treat seed with hot water, then use captan or thiram.
Bacterial spot	Use crop rotations of 2-3 years, excluding small grains and tomatoes. Control broadleaf weeds in field borders. Apply copper plus streptomycin to seedlings. After transplanting, apply fixed copper plus maneb or mancozeb, on a 5- to 7-day interval. Purchase only certified, disease-free transplants. Planting peppers in narrow strips between early planted corn may help reduce spread during severe rain and wind storms.
Anthracnose, Cercospora leaf spot, other fungal leaf spots, and fruit rots	Apply maneb or zineb after first fruits form on a 5- to 7-day interval.
Verticillium wilt	Fumigate soil with Vapam, Vorlex, or methyl bromide plus chloropicrin.
Virus diseases	Grow resistant varieties. Control aphids and broadleaf weeds in and around fields. Plant only healthy transplants.
Potatoes (Irish)	
General	Purchase only certified seed. Seed-production fields should be inspected for virus, nematode, or fungal disease problems.
Seedpiece decay, seed-borne Verticillium wilt, and Blackleg	Treat seed with captan, maneb, or mancozeb. Keep seed storage at approximately 40° F. during the winter. In the spring, warm the seed to 60°-70° F. for 1.5-2 weeks before cutting. Streptomycin may be added to fungicide dusts to improve the control of bacterial diseases.
Scab	Plant resistant varieties. Do *not* apply manure or other organic matter immediately before the potato crop. Working PCNB into the top 4-6 inches of the soil at or before planting may help.
Storage rots	Store healthy, sound, unbruised potatoes. Maintain a proper storage environment. Apply Mertect 340F as a spray to unwashed tubers before storage. This will help control Fusarium dry rot.
Rhizoctonia	Use a Terraclor EC soil treatment.
Verticillium wilt	Practice crop rotation, use only seed free of Verticillium. Control root-knot and root-lesion nematodes. Soil fumigation with Vapam or Vorlex may be practical.
Nematodes	Where soil samples indicate damaging levels of nematodes, apply Temik or fumigate with Vapam, Vorlex, D-D, or Telone C.
Early blight and late blight	Apply maneb, mancozeb, Difolatan, Bravo, Polyram, Du-Ter, or Dyrene on 7- to 10-day schedule. Mainain an adequate supply of nitrogen throughout the season to provide good control of early blight.
Virus diseases and Purple-top wilt (Aster yellows)	Plant certified seed only. Control aphids and leafhoppers with insecticides.
Rhubarb (greenhouse only)	
Botrytis leaf rot	Apply after budding and at weekly intervals until harvest.
Crown and root rots	Plant only in well-drained soil. Maintain optimal soil fertility. Drench the crowns with fixed copper at 3 pounds per acre in the early spring and after harvest if crown rot is a problem.
Spinach	
Seed rot and damping-off	Treat seed with captan or thiram.
Downy mildew or blue mold, White rust, anthracnose, and other fungal leaf diseases	Grow resistant varieties or spray with captan, maneb, or zineb on a 5- to 7-day schedule starting before the plants begin to rosette.
Cucumber mosaic virus or blight	Grow resistant varieties.

CONDENSED RECOMMENDATIONS ON DISEASE MANAGEMENT (concluded)

Vegetable	Disease management practices
Sweet potatoes	
Black rot, foot rot, Fusarium wilt and scurf	Grow resistant varieties. Plant disease-free roots and use crop rotations of 3-4 years. Dip the roots or sprouts in Botran or Mertect 340F.
Storage rots	Fumigate storage crates and houses with formaldehyde. Use Botran as a postharvest dip. Store only healthy, blemish-free roots.
Nematodes	Plant resistant varieties. Use crop rotation. Temik, Mocap, or Dasanit may be used for chemical control.
Tomatoes (field)	
Seed decay, damping-off, and seed-borne diseases	Plant hot water- or copper-treated seed that has been treated with captan or thiram.
Bacterial spot and bacterial speck	Purchase certified, disease-free plants. Use crop rotations of 2-3 years, excluding small grains. In the seed bed, spray with fixed copper plus streptomycin. After transplanting, spray with fixed copper plus mancozeb. Once established, bacterial spot is difficult to control.
Septoria blight, early blight, buckeye rot, gray leaf spot, and leaf mold	Apply maneb, mancozeb, Polyram, zineb, Dyrene, Bravo, or Difolatan on a 7- to 10-day schedule after the first sign of disease or after the first fruits form. Difolatan may be used only on machine-harvested fruit. A soil surface spray of Difolatan or maneb after the last cultivation will improve anthracnose control. Benlate may be use for Botrytis and Septoria control.
Blossom-end rot	Mulch plants or maintain uniform soil moisture. Applications of calcium nitrate starting when the fruits are grape size may reduce losses.
Verticillium wilt and Fusarium wilt	Grow resistant varieties.
Viruses	Take care to avoid infecting the seedlings. Start with virus-free seed. Control insects and broad-leaf weeds in and around fields. See greenhouse tomatoes below.
Tomatoes (greenhouse)	
Virus diseases	Start with hot water-treated seed. Do not allow the use of tobacco on the premises. Smokers should wash their hands with soap and hot water before working with plants. If possible, plant TMV-resistant hybrids. Control insects. Remove infected plants if possible.
Botrytis gray mold, leaf mold, and gray leaf spot	Avoid excessive humidity by heating and venting, especially at night during the late fall, early winter, and early spring. Spray weekly with Benlate, mancozeb, or Bravo *or* fumigate with Exotherm Termil.
Nematodes, root rots, and soil-borne TMV	Steam the plant beds.

GENERAL SUGGESTIONS ON FUNGICIDE APPLICATION

1. Cover the foliage uniformly. *Ground equipment* — Apply 75 to 125 gallons per acre at approximately 400 pounds per square inch of pressure. Lowering volumes and/or pressures may provide adequate coverage, but high-volume, high-pressure applications provide ideal coverage. Make sure the sprayer is functioning properly. Check the nozzles for cleanliness and wear. Boom, height, accuracy of pressure gauge, agitation, and calibration should also be checked. *Aerial application* — Apply recommended amounts of pesticide per acre in 3 to 5 gallons of water. Make sure nozzles are properly aligned and clean, so uniform application is achieved. Cover a swath no wider than is reasonable for the aircraft and boom being used. Spray only those fields which are suitable for aerial application. Avoid fields of irregular shape or topography, particularly if they are bounded by power lines, trees, or other obstructions.
2. Whenever possible spray when the air is still or when wind velocity is not excessive (less than 10 to 12 mph).
3. Avoid situations where pesticide drift may cause needless problems.
4. When it is compatible with the product label, use a spray adjuvant (surfactant). Some commonly available surfactants are: Colloidal Products X77 (liquid, non-ionic) spreader activator; Colloidal Products Multifilm L. (liquid); Colloidal Products Spray Modifier (liquid, non-ionic) spreader sticker; Millers Nufilm 17 liquid spreader sticker; Millers Nufilm P liquid spreader sticker; Allied Chemical Plyac (liquid) sticker; Rohm and Haas Triton B — 1956 (liquid, non-ionic) spreader sticker; Triton CS7, spreader-binder; and Du Pont Spreader Sticker (liquid) spreader sticker.

GENERAL SUGGESTIONS ON SOIL FUMIGATION

Follow the manufacturer's directions exactly. Fumigants work best in light, loose soils that are free of trash, clods, and lumps. Avoid recontaminating treated soil. It is best to apply fumigants during the fall before planting. In general, the soil temperature must be at least 55° F. at the 6-inch depth, with a time lapse of 21-28 days between treating and seeding. Some require gas-tight plastic covers.

RECORD SHEET FOR FUNGICIDE USERS

Date	Vegetable	Chemical	Dosage per acre	Remarks

1982 Insect Pest Management Guide

COMMERCIAL VEGETABLE CROPS AND GREENHOUSE VEGETABLES

Restricted-use insecticides are identified with an asterisk (*).
You must be certified as a pesticide applicator to use restricted-use pesticides.
See your county Extension adviser in agriculture for information.

Commercial vegetable gardeners find it impossible to produce vegetables profitably unless they control insects at maximum efficiency and minimum cost. The housewife of today will not accept unsightly wormy vegetables; not only are wormy fruits and vegetables unappetizing but the waste from trimming increases food costs. Thus the commercial vegetable gardener must produce a quality product that is acceptable and safe to the consumer. Careful use of the right insecticides will enable him to do this.

Insect pest-management programs, which include the wise selection of cultural, mechanical, biological, and chemical methods, are suggested for the major insect pests of vegetable crops. Insecticides, though, are still the most efficient means of managing most insects.

This suggested insecticide guide has been prepared for use by Illinois commercial vegetable farmers; it is not for home gardeners, who should use only those insecticides that are extremely safe to handle, apply, and store. Furthermore, the commercial vegetable gardener must use a wider variety of insecticides than the home gardener in order to obtain maximum insect control at the least cost.

In using insecticides, read the label and carefully follow the instructions. Do not exceed maximum rates suggested; observe carefully the interval between application and harvest, and apply only to crops for which use has been approved. Make a record of the product used, the trade name, the percentage content of the insecticide, the dilution, the rate of application per acre, and the dates of application.

Some of the insecticides suggested here can be poisonous to the applicator. In using them, the commercial grower is expected to use precautions to protect himself, his workers, and his family from undue or needless exposure.

In using this guide, always refer to the table on the next page, which lists the limitations and restrictions on use. These limitations apply to the vegetables as human food. If you use any portion of a vegetable for livestock food (tops, stalks, etc.), refer to the label for instructions as to the interval required between application and feeding.

The chemical names used in these tables may be unfamiliar to you. These names are the common coined chemical names and as such are not capitalized. Trade names are capitalized. In the table of limitations the common names are listed first. If the trade name is more commonly used, it is listed in parentheses following the common name. Throughout the tables of suggestions, however, the common name is used if there is one. In case you have a question, refer to the table of limitations.

These suggestions are subject to change without notification during the growing season.

Requested label clearances for a few uses of insecticides, carriers, and solvents are uncertain for 1981, since many requests have not been officially cleared. Anticipating needed changes in labeling, we began modifying these suggested uses a few years ago.

Check with your county Extension adviser if you are in doubt about the insecticide you plan to use. We will make announcements of label changes through newsletters and the news media to keep you up to date.

Insecticides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. A person wishing to use an insecticide classified for restricted use must be certified as a private or commercial pesticide applicator by the Illinois Department of Agriculture. Contact your county Extension adviser in agriculture for details on this program.

A few insecticides have been classified at this time. More will be classified later.

Suggestions for the effective use of insecticides from a practical standpoint are based on available data. Soil textures, pH of the soil, rainfall, slope of the field, wind velocity at planting, method and accuracy of application, and other unpredictable factors affect efficiency.

This publication was prepared by entomologists of the University of Illinois College of Agriculture and the Illinois Natural History Survey.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
In cooperation with ILLINOIS NATURAL HISTORY SURVEY CIRCULAR 897 (revised annually) November, 1981

LIMITATIONS FOR FIELD VEGETABLES IN DAYS BETWEEN APPLICATION AND HARVEST AND OTHER RESTRICTIONS ON USE OF INSECTICIDES IN ILLINOIS

(Blank spaces indicate that the material is not suggested for the specific use in Illinois)

Insecticide	Beans	Peas	Broccoli	Brussels sprouts	Cabbage	Cauliflower	Horseradish	Radish	Turnip	Onions	Eggplant	Peppers	Tomatoes
acephate (Orthene)	14	...	..	..	..	..	..	..	....	....	..	7	..
*azinphosmethyl (Guthion)[2]	..	...	15	7	21	15	..	..	....	....	..	..	..
Bacillus thuringiensis[3]	..	...	0	0	0	0	..	..	....	....	..	..	0
carbaryl (Sevin)	0	...	3	3	3	3	3	3	3, 14A	....	0	0	0
carbofuran (Furadan)	..	...	..	..	..	..	..	..	....	....	..	21B	...
chlorpyrifos (Lorsban)	..	...	C	C	C	C	..	C	....	....	..	..	..
Dasanit	..	...	..	..	..	..	..	..	....	C, D	..	..	...
*demeton (Systox)	..	...	..	..	..	..	..	..	....	....	..	3	...
diazinon	..	...	5	..	7	5	..	10	10	10	..	..	1
dicofol (Kelthane)	7E	...	..	..	..	..	..	..	....	....	2	2	2
dimethoate (Cygon)	0E	0E	7	..	3	7	..	..	14	....	..	0	7
Dyfonate	..	...	C	..	C	C	..	..	....	C, D	..	..	..
ethion	..	...	..	..	..	..	..	..	....	C	..	..	..
malathion	1	...	3	7	7	7	7	7	3	3	3	3	1
*methomyl (Lannate)	1	1, 5A	3	3	1	3	..	..	....	....	..	10	2
*mevinphos (Phosdrin)[2]	..	...	1	3	1	3	..	..	3	....	..	..	..
Monitor	..	...	21	21	35	28	..	..	....	....	..	..	..
naled (Dibrom)	..	...	1	1	1	1	..	..	4	....	..	..	..
oxydemetonmethyl (Meta-Systox R)	..	...	..	..	..	..	..	..	....	....	7F	0B	..
*parathion[2]	7	...	7	7	10	7	..	15	10	....	15	15	10
phorate (Thimet)[2]	C	...	..	..	..	..	..	..	....	....	..	..	..
rotenone	..	...	..	..	..	..	..	..	....	....	1	1	1
trichlorfon (Dylox)	..	...	..	21	21	21	..	..	28E	....	..	21	21

Insecticide	Potatoes	Collards	Kale	Lettuce	Spinach	Swiss chard	Sweet corn	Cucumbers[1]	Melons[1]	Pumpkins[1]	Squash[1] Winter	Squash[1] Summer
Bacillus thuringiensis[3]	..	0	0	0	0	..	..	..	..	..	..	..
carbaryl (Sevin)	0	14	14	14	14	14	0	0	0	0	0	0
carbofuran (Furadan)	14H	..	..	..	..	..	..	..	..	..	..	..
chlorpyrifos (Lorsban)	..	..	..	..	..	..	50A, J	..	..	.	..	..
diazinon	..	10	10	10	10	12	C	7	3	..	3	7
dicofol (Kelthane)	..	..	..	..	..	..	..	2	2	2	2	2
dimethoate (Cygon)	0	14	14	14	14	14	..	..	3	..	..	..
Dyfonate	..	..	..	..	..	..	C	..	..	..	..	..
fenvalerate (Pydrin)	7E	..	..	..	..	..	..	..	..	..	..	..
isofenphos (Amaze)	..	..	..	..	..	..	I	..	..	..	..	..
malathion	0	7	7	14	7	7	5	1	1	3	1	1
*methomyl (Lannate)	6	..	..	10	7	..	0, 3A	3	3	..	..	3
*mevinphos (Phosdrin)[2]	..	3	3	2	4	..	..	..	..	..	..	..
Mocap	..	..	..	..	..	..	C	..	..	..	..	..
naled (Dibrom)	..	4	4	1	1	1	..	..	..	..	..	..
*parathion[2]	5	10	10	21	14	21	12	15	7	10	15	15
phorate (Thimet)[2]	C	..	..	..	..	..	C	..	..	..	..	..
rotenone	..	1	1	1	1	1	..	..	..	..	..	..
terbufos (Counter)	..	..	..	..	..	..	C	..	..	..	..	..
trichlorfon (Dylox)	..	28G	21	28G	..	..	..	..	..	3F	..	..

* Use restricted to certified applicators only.

[1] Apply insecticides late in the day after the blossoms have closed to reduce bee kill.
[2] For use only by professional applicators or commercial gardeners.
[3] The trade names are Bactur, Dipel, Thuricide, and Sok Bt.

A. If tops or stover are to be used for feed.
B. Not more than twice per season.
C. Soil applications at planting time only.
D. Do not use on green onion crop.
E. Do not use tops for feed or food.
F. Not more than 3 times per season.
G. Not after edible portions or heads begin to form.
H. Not more than 8 times per season.
I. Crops other than corn and soybeans may be planted 10 months after application.
J. Not more than once per season.

REENTRY INTERVALS FOR WORKER PROTECTION

Insecticide	Hours
azinphosmethyl (Guthion)	24
demeton (Systox)	48
ethion	24
parathion	48

Workers must wear protective clothing if they enter treated fields before the time intervals shown at the right. They must also wear protective clothing for all other insecticides applied if the spray has not dried or the dust has not settled.

CABBAGE AND RELATED COLE CROPS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Cabbage maggots[1] (NHE-44)	All season	diazinon Dyfonate	3 2	Broadcast	Disk in just before planting. Use only for cabbage, cauliflower, and broccoli.
		diazinon granules	1	Furrow	At time of planting; on turnips a drenching spray of 1 lb. diazinon should be applied 30 days following treatment.
		*azinphosmethyl	3 oz. W.P. or 2 oz. E.C. per 50 gal. transplant water		6 fluid oz. transplant water per plant.
		diazinon	4 oz. per 50 gal. transplant water		
		Lorsban	3 oz. 4E per 1,000 ft. of row		Transplant drench to cabbage, broccoli, and cauliflower.
		Lorsban	1 oz. 4E per 1,000 ft. of row	Furrow	Radishes only.
Aphids (NHE-47) Thrips (NHE-48)	All season	*azinphosmethyl dimethoate malathion *mevinphos *parathion	¾ 0.3 1 ¼ 0.4	Foliage	When aphids appear, but before leaves begin to curl.
Cabbage loopers (NHE-45); diamond-back moth larvae; imported cabbage worms	All season	*Bacillus thuringiensis* *methomyl *Monitor	See rates on label 0.45-0.9 1	Foliage	When small worms first appear, and about every 5 to 7 days thereafter. Thorough spray coverage of foliage is important.
Cutworms	At planting	trichlorfon	1	Soil	At planting, at base of plant or as needed when damage first occurs.
Flea beetles and leafhoppers	All season	carbaryl	1½	Foliage	As needed.

E.C. = emulsion concentrate; W.P. = wettable powder.

* Use restricted to certified applicators only. [1] Maggots are resistant to diazinon in some areas of Illinois.

COLLARDS, KALE, LETTUCE, SPINACH, SWISS CHARD

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Aphids (NHE-47)	All season	diazinon dimethoate *mevinphos naled *parathion	½ 0.3 ¼ 1 0.4	Foliage	As needed.
Cutworms	On seedling plants	trichlorfon[1]	1	Base of plant and soil	When first damage appears.
Leafhoppers	All season	carbaryl dimethoate malathion	1½ 0.3 1	Foliage	When first leafhoppers appear, and as needed.
Caterpillars (NHE-45)	All season	*Bacillus thuringiensis* *methomyl[2] naled	See rates on label 0.45 1	Foliage	When small worms first appear and every 5 to 7 days thereafter.
Leaf miners	All season	diazinon dimethoate *parathion	½ 0.3 0.4	Foliage	When first miners are observed.
Flea beetles	All season	carbaryl rotenone	1 ¼	Foliage	As needed.

* Use restricted to certified applicators only.

[1] Do not use on spinach or Swiss chard.
[2] Use limited to lettuce and spinach only.

BEANS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Seed maggots (NHE-27)	All season	diazinon 50% W.P.[1] Lorsban 25% W.P.[1]	3/5 oz./bu. 2 oz./bu.	Seed Seed	Treat seed no longer than 3 months bef[ore] planting.
		phorate granules	1½	Soilband	Place on either or both sides of row planting but not in contact with seed.
Bean leaf beetles (NHE-67)	Early and late season	carbaryl malathion	1 1	Foliage	When feeding first appears and wee[k] for 2 or 3 applications as needed.
Leafhoppers (NHE-22) and plant bugs (NHE-68)	All season	carbaryl dimethoate malathion *methomyl	1 0.3 1 0.45	Foliage	Before plants become yellow and stunt[ed]. Repeat applications at weekly interv[als] as necessary.
		phorate granules	1½	Soilband	As for seed maggot.
Mexican bean beetles	Midseason and late season	carbaryl malathion	½ 1	Foliage	When occasional leaves show lacewo[rk] feeding.
		phorate granules	1½	Soilband	As for seed maggot.
Aphids (NHE-47)	All season	dimethoate malathion	0.3 1	Foliage	Usually applied when a few aphids can [be] found on each plant, but before leav[es] begin to curl and deform.
		phorate granules	1½	Soilband	As for seed maggot.
Blister beetles (NHE-72)	Midseason and late season	carbaryl	1½	Foliage	As needed.
Corn earworms (NHE-33) Corn borers	Late season	acephate carbaryl *methomyl *parathion	⅔ 1½ 0.45 ½	Foliage	As needed, but usually after August 2[0]. Worms may be present before bloom.
Mites	Midseason and late season	dicofol dimethoate malathion	0.4 0.3 1	Foliage	As needed, but especially during drouth periods particularly if carbaryl has bee[n] used on crops.
		phorate granules	1½	Soilband	As for seed maggot.

* Use restricted to certified applicators only. [1] No restrictions when used as recommended.

CUCUMBERS AND OTHER VINE CROPS[1]

Insect	Time of attack	Insecticide[2]	Pounds of active ingredient per acre	Placement	Timing of application[1]
Striped and spotted cucumber beetles (NHE-46)	Seedling to mature plants	carbaryl *parathion	1 ½	Foliage	When beetles first appear; as often a[s] necessary thereafter.
Aphids (NHE-47)	All season	diazinon dimethoate[2] malathion *parathion	½ 0.3 1 ½	Foliage	When aphids become noticeable.
Squash bugs (NHE-51)	All season	*parathion trichlorfon[3]	½ 1	Foliage	Do not apply until first eggs are foun[d] hatching (about June 15 to July 15); con trols only nymphs.
Leafhoppers	July-August	malathion dimethoate[2]	1 0.3	Foliage	As needed.
Squash vine borers	June-September	carbaryl	1	Base of stem for 3 ft.	Weekly applications when vines begin t[o] run—usually 5 applications.
Pickle worms	August-September	carbaryl	1	Foliage	Weekly applications, beginning in lat[e] August.
Mites	July-September	dicofol malathion *parathion	½ 1 ½	Foliage	As needed.
Cutworms (NHE-77)	April-June	carbaryl	2	Base of plants	As needed.

* Use restricted to certified applicators only.

[1] Spray vine crops with insecticide only late in the day after blossoms have closed to reduce bee kill. [2] Do not use dimethoate on cucumbers.
[3] Pumpkin is the only vine crop for which trichlorfon can be used for squash bug control.

TOMATOES AND EGGPLANT

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Cutworms (NHE-77)	Early and midseason	carbaryl trichlorfon	2 1	Base of plants or foliage	As needed.
Flea beetles	May-June	carbaryl rotenone	2 0.2-0.4	Foliage	Apply every week as long as needed.
Aphids (NHE-47)	May-July	diazinon dimethoate[1] malathion *parathion	½ 0.3 1 0.4	Foliage	As needed, but before leaves curl.
Cabbage loopers	July-September	*Bacillus thuringiensis* *methomyl	See rates on label 0.45-0.9	Foliage	When loopers are present.
Corn earworms Corn borers Hornworms	July-September	carbaryl *methomyl[1]	2 0.45-0.9	Foliage	Add to weekly applications of fungicide sprays beginning at first fruit set when first small worms appear.
Mites	July-September	carbophenothion dicofol malathion *parathion	1 ½ 1 0.4	Foliage	As needed.
Russet mites	July-September	*parathion sulfur dust[2] sulfur spray[2]	0.4 10 10	Foliage	As needed.
Blister beetles (NHE-72)	June-September	carbaryl *parathion	1½ ¼	Foliage	As needed.
Fruit flies and picnic beetles	August-October	carbaryl diazinon	2 ½	Foliage	When flies or beetles first appear.

* Use restricted to certified applicators only. [1] Use cleared only on tomatoes. [2] No limitations on use.

PEPPERS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Aphids (NHE-47)	May-July	dimethoate demeton *methomyl oxydemetonmethyl acephate	0.3 ⅜ 0.45 ½ ½	Foliage	Only when aphids are present. Add to borer spray when it is being used.
Corn borers	Late season	carbaryl acephate	2 1	Foliage and fruit	When fruit is present on plant. Apply every 5 days when borers are present.
		carbofuran	2-3	Soilband to transplant	Make 2 applications; first, 3 weeks after transplant, second, 5 weeks later.

* Use restricted to certified applicators only.

ASPARAGUS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Asparagus beetles (NHE-49)	Early and mid-season on spears and ferns	carbaryl[1] malathion[1]	1½ 1	Spears and ferns	As needed, not more often than every 3 days.
		rotenone[1]	0.2-0.4	Spears	As needed.

[1] One-day restriction between last application and harvest.

SWEET CORN

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Soil insects (NHE-26, 27, 43)	April-August	Amaze Counter diazinon Dyfonate Lorsban Mocap phorate	1 1 1 1 1 1 1	Row	Apply on soil surface behind planter s and ahead of press wheel. Rootworm c trol may be needed if the corn was sprayed the previous year.
Cutworms (NHE-38)	April-June	carbaryl[1] Lorsban 4E	2-3 1½	Base of plants Broadcast	When first damage appears.
Flea beetles (NHE-36)	April-July	carbaryl[1]	1½	Foliage	As necessary.
Japanese beetles (NHE-32)	July-September	carbaryl[1]	1	Ear zone	As necessary.
First-generation corn borers	June	carbaryl[1]	2	Foliage	Make first application when tassel ra is 30 to 40. Repeat in 4 to 5 days.
Second-generation corn borers and corn earworms[2] (NHE-33)	June-September	carbaryl[1] *methomyl	2 0.45	Ear zone	*Fresh market corn:* At first silk and eve 2 to 3 days for 5 to 8 applications. *Ca ning corn:* Observe light traps for earwo and borer adults, or keep a record of t heat units. When 1,500 or more heat uni have accumulated, begin a spray pr gram. As an alternative, begin at 30 50% silk and every 3 days thereafter un the corn is within 8 to 12 days of harves
Sap beetles (NHE-10) Picnic beetles	July-September	carbaryl[1] diazinon malathion *parathion	2 1 1 ½	Foliage	When adults first appear in field; usual between pollen-shedding and silk-dryin
Corn leaf aphids (NHE-29)	July-September	malathion *parathion	1 ½	Foliage	As needed to produce attractive ears f fresh market.
Fall armyworms	July-September	*methomyl *parathion	0.45 ½	Foliage	Apply to ear zone when whorl feeding evident.

* Use restricted to certified applicators only.

[1] During pollen shed, apply carbaryl as late in the day as possible (preferably after 4 p.m.) to reduce bee kill. [2] Adding 0.5 to 0.75 pound o parathion or 0.25 to 0.45 pound of methomyl to carbaryl improves earworm control.

ONIONS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Onion maggots (NHE-50)	All season	diazinon W.P ethion W.P.	½-1 for 40-50 lb. of seed 1 for 40-50 lb. of seed	Seed	Seed treatment for set onions only. Us lighter dosage of diazinon on sandy, highl mineral soils.
		Dasanit granules diazinon granules Dyfonate ethion granules	1 ½-1 1 ½-2	Furrow	Use 1 lb. active ingredient per acre fo rows 12″ apart; ¾ lb. for rows 18″ apart ½ lb. for rows 24″ apart. Up to twic these amounts are needed for ethion o muck soils. Do not use Dasanit or Dyfon ate on green onions.
		diazinon	2	Broadcast	Preplanting; disk into upper 1 to 2 inche of soil. Supplement with foliage spra below.
		diazinon malathion	⅓ 1	Foliage	Supplemental to soil treatment. Mak first application when first adult flies ar seen; make another 1 week later. Fron then on only as necessary.
Thrips (NHE-48)	Midseason and late season	diazinon malathion *azinphosmethyl	½ 1 ½	Foliage	When injury first appears and every 1 days as necessary.

* Use restricted to certified applicators only.

POTATOES

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Flea beetles	May-July	carbaryl	1	Foliage	When damage first appears on the leaves. Repeat as needed.
		carbofuran granules	3	In furrow	Planting time.
		carbofuran spray	1	Foliage	As needed.
		fenvalerate	0.1	Foliage	As needed.
		*methomyl	0.45	Foliage	As needed.
Colorado potato beetles; cutworms; potato leafhoppers (NHE-22)	May-July	carbaryl	2	Foliage	As needed.
		carbofuran granules	3	In furrow	Planting time.
		carbofuran spray	1	Foliage	As needed.
		dimethoate	0.3	Foliage	As needed.
		fenvalerate	0.1	Foliage	As needed.
		phorate granules	2-3	Soilband	Place on either or both sides of row at planting, but not in contact with seed. Use the lower rate on sandy soils, the heavier rate on heavy soils. Do not use on muck soils.
Aphids (NHE-47)	All season	dimethoate	0.3	Foliage	As needed.
		*methomyl	0.45		
		*parathion	¼		
		phorate granules	2-3	Soilband	Same as for leafhoppers.
Blister beetles (NHE-72)	All season	carbaryl	1½	Foliage	As needed.
Wireworms (NHE-43) White grubs (NHE-23)	All season	phorate granules	2-3	Soil	Preplanting, disk in; or use as soilband at planting.
Grasshoppers (NHE-74)	July-September	carbaryl	¾	Foliage	As needed, control in fence rows, roadsides, ditch banks, etc., before migration.
		dimethoate	0.3		

* Use restricted to certified applicators only.

PEAS

Insect	Time of attack	Insecticide	Pounds of active ingredient per acre	Placement	Timing of application
Caterpillars, including loopers	June	*methomyl	½-1	Foliage	Before harvest if worms are present.
Aphids	May-June	dimethoate	⅓	Foliage	As needed.

* Use restricted to certified applicators only.

FOR ADDITIONAL INFORMATION

Obtain the following circulars on insect control from the Office of Agricultural Publications, 123 Mumford Hall, Urbana, Illinois 61801.

Circular 899, 1981 Insect Pest Management Guide — Field and Forage Crops

Circular 900, 1981 Insect Pest Management Guide — Home, Yard, and Garden

Circular 1076, 1981 Turfgrass Pest Control

Leaflets describing the life history, biology, and habits of some of the insects mentioned can be obtained from the offices of county Extension advisers or by writing to Entomology Extension, 172 Natural Resources Building, Urbana, Illinois 61801. These are indicated by an NHE number in the tables.

FOR YOUR PROTECTION

Always handle insecticides with respect. The persons most likely to suffer ill effects from insecticides are the applicator and his family. Accidents and careless, needless overexposure can be avoided. Here are a few easy rules that if followed will prevent most insecticide accidents:

1. Wear rubber gloves when handling insecticide concentrates.
2. Do not smoke while handling or using insecticides.
3. Keep your face turned to one side when opening insecticide containers.
4. Leave unused insecticides in their original containers with the labels on them.
5. Store insecticides out of reach of children, irresponsible persons, or animals; store preferably in a locked cabinet.
6. Triple-rinse and bury or burn all empty insecticide containers or take to an approved sanitary landfill.
7. Do not put the water-supply hose directly into the spray tank.
8. Do not blow out clogged nozzles or spray lines with your mouth.
9. Wash with soap and water exposed parts of body and clothes contaminated with insecticide.
10. Do not leave puddles of spray on impervious surfaces.
11. Do not apply to fish-bearing or other water supplies.
12. Do not apply insecticides, except in an emergency, to areas with abundant wildlife or to blossoming crops visited by bees. Avoid drift onto blossoming crops or onto bee hives.
13. Do not apply insecticides near dug wells or cisterns.
14. Do not spray when weather conditions favor drift.
15. Observe all precautions listed on the label.
16. To avoid bee kill, apply insecticides after bee activity has been completed for the day; use the least toxic materials. *Warn beekeepers that you are applying insecticides.*

Weed Management Guide 1982

FOR COMMERCIAL VEGETABLE GROWERS

Restricted-use herbicides are identified with an asterisk(*).
You must be certified as a pesticide applicator to use restricted-use pesticides.
See your county Extension adviser in agriculture for information.

WEED GROWTH reduces the income of vegetable growers in the United States by millions of dollars annually as a result of lower yields, poorer quality, and added labor in harvesting and processing.

This guide should be used together with the grower's knowledge of soil types and the crop and weed history of the area to be treated. Whether to use herbicides or other means of weed control depends in part on the severity of past weed infestations. In some instances, mechanical control may be sufficient. If so, shave off weeds with a sharp hoe or cultivator while gently breaking up the crust. Deep tillage causes severe injury to many shallow-rooted plants and helps place a fresh supply of weed seeds in position to germinate. Keeping equipment sharp and in good condition will help reduce injury to desirable plants. Hoe carefully around your plants, and hand pull weeds close to the plants.

For warm season crops such as fresh market tomatoes, peppers, eggplant, cucumbers, and melon, black polyethylene mulch will control annual weeds, conserve moisture, and increase the soil temperature in early spring. The higher temperature increases early season growth. Natural mulch materials may require considerable hand labor for application. Most organic materials are bulky and must be hauled to the place of use. This is a problem for large commercial plantings. Organic mulches tend to reduce soil temperature.

Herbicide application may be needed in addition to mechanical control. Several herbicides may be suggested for some crops. These herbicides have shown good control with no injury to the vegetables under test conditions. Not all herbicides cleared for use on a species are necessarily listed. Where the choice of more than one herbicide is suggested, the decision rests with the grower and is based on his knowledge of past weed infestations, crop rotations, and material costs. Where one herbicide will not control the weeds present, a combination of herbicides may be suggested. When using a herbicide for the first time, it is advisable to use a small-scale trial.

These suggestions for weed control in vegetables are based on research at the Illinois Agricultural Experiment Station, the U.S. Department of Agriculture, and other research institutions. The University of Illinois and its agents assume no responsibility for results from the use of herbicides, whether or not they were used in accordance with suggestions, recommendations, or directions of the manufacturer or any governmental agency.

Reading the label of the herbicide container is the most profitable time you spend in weed control. Use of the material and methods of application and use depend on registration of the herbicide by federal and state Environmental Protection Agencies (EPA). Do not use any herbicide *unless the label states that it is cleared for the use on the crop to be treated.*

Herbicides are being classified for *general use* or *restricted use* by the U.S. Environmental Protection Agency. A person wishing to use a herbicide classified for restricted use must be certified as a private or commercial pesticide applicator by the Illinois Department of Agriculture. Contact your county Extension adviser in agriculture for details about this program.

Only a few herbicides have been classified at this time. More may be classified later.

When applying mixtures of chemicals, the *user* assumes responsibility for freedom from residues if the mixture is not labeled by the EPA.

Suggestions sometimes change during the growing season, based on EPA clearances that were made after this circular was issued. This publication, printed once a year, is subject to change without notification.

Watch for notice of changes in the EPA registration of herbicides (as released by the EPA) in the *Illinois Vegetable Farmer's Letter* and the *Insect, Weed, and Plant Disease Survey Bulletin.* Subscription forms for the latter are available from the Agricultural Newsletter Service, 116 Mumford Hall, 1301 West Gregory Drive, Urbana, Illinois 61801, or your county Extension Office. You can obtain the *Vegetable Farmer's Letter* from Vegetable Crops Extension, University of Illinois, 1103 West Dorner Drive, Urbana, Illinois 61801.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
Prepared by H. J. Hopen, Department of Horticulture (revised annually) CIRCULAR 907 (October 1981)

For Application During the Growing Season (1982 Only)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Asparagus (seedlings)	Amiben	3 lb.	Annuals	Immediately after seeding	Irrigation or rainfall after treatment will give maxi control.
Asparagus (established plantings)	dalapon	5-10 lb.	Perennial grass	End of harvest season following disking	Apply when grass weeds are 3 to 4 inches tall. D spray under fern growth. Use surfactant as directe label.
	diuron	1-4 lb.	Annuals	In spring, after harvest, or both	Apply after disking. Do not exceed 6 pounds per gro season. Use a lighter rate on sandy soil. With di and Princep, a spring application may be sufficient the first year.
	Princep	3-4 lb.	Annuals	In spring, after harvest, or both	Apply after disking. Do not treat during the last yea asparagus because of residue.
	Sinbar	1.2-2.4 lb.	Annuals	In spring, after harvest, or both	Use lower rates on coarse soils. Do not apply more 2.4 lb. per acre per year. Do not use on soils with than 1 percent organic matter. Do not plant to any o crop for two years after application.
	metribuzin	1-2 lb.	Primarily broadleaf weeds	Early spring before the spears emerge or after harvest	Apply after disking. Do not apply within 14 days of vest. Can help control broadleaf weeds when used dalapon, diuron, or Princep. Do not apply more th lb. per acre per growing season.
	Perennial weed control, applications during and outside the growing season (See separate listing at the end of this table.) Stale seedbed before crop emergence (See separate listing at the end of this table.)				
	Preemergence				
Beans, dry, lima, and snap	Treflan	0.5-0.75 lb.	Annuals[3] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Plant crop immediately, or within 3 weeks after appl tion. Can be used up to 1 pound per acre on dry bean
	Tolban	0.5-1 lb.	Primarily annual grasses	Preplant soil incorporation Premerge-3	
	Premerge-3	6-7.5 lb.	Annuals	Can be used between planting and crop emergence	Do not use on light, sandy soil. Some stand reduction result from use. See label for precautions.
	Postemergence				
	Basagran	0.75-1 lb.	Annual broadleaf weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after the first trifoliate leaf appears on beans	Can provide good, broad-spectrum control when combi with a grass-active herbicide. Do not mix with other ticides. See Basagran entry under corn, postemergence Canada thistle and nutgrass control.
	Perennial grass control, applications outside the growing season (See separate listing at the end of this table.)				
Beans, lima and dry	Amiben	2-3 lb.	Broad spectrum of annual weeds	Immediately after seeding, or preplant-incorporated for lima beans	Field may be rotary-hoed without destroying herbic action.
Beans, snap	Eptam	3 lb.	Annual grasses and nutgrass[5]	Preplant soil application, incorporate with soil immediately	
	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	Do not feed treated plant parts to livestock.
Beans, dry	Cobex	0.3-0.6 lb.	Annuals	Preplant soil incorporation	
Beets, garden	Pyramin	4 lb.	Annuals (primarily broadleaved)	Preemergence or after beets emerge and before weeds have two true leaves	Rainfall or irrigation needed to activate. Where gras are a severe problem, use 4 pounds of Pyramin plus pounds of Ro-Neet.
	Ro-Neet	4 lb.	Annual grasses	Preplant soil application, incorporate with soil immediately	Use a combination treatment with Pyramin to broad control spectrum.
	Direct-seeded or transplanted				
Broccoli Brussels sprouts	Treflan	0.5-0.75 lb.	Annuals[3] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Stunting or growth reduction may occur at recoi mended rates under growth stress conditions. Can be us up to 1 pound per acre on transplants.
Cabbage Cauliflower	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding. Can also be incorporated preplant	
	Preemergence				
Carrots	Treflan	0.5-1 lb.	Annuals[3] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Seed after application to 3 weeks later.
	Postemergence				
	Lorox	0.75-1.5 lb.	Annuals	Postemergence on carrots only after the crop is 3 inches tall; grasses, less than 2 inches; broadleaves, less than 6 inches	Do not feed treated foliage to livestock or replant treat area for 4 months. More than one application may made, but do not exceed a total of 2 pounds per acre. not use over 40 PSI. Use no surfactants when temper tures exceed 80°F., or crop injury may result.

Carrots continued on the next page.

(See notes at the end of the table.)

For Application During the Growing Season (continued)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
ırrots ontinued)	Stoddard Solvent	60-80 gal.	Annuals	After two true leaves have appeared (do not apply to carrots or parsnips after they are ¼ inch in diameter, since an oily taste may result)	Most effective when sprayed on cloudy days or during high humidity, and when weeds are not more than 2 inches high. May not control ragweed. Do not apply within 40 days of harvest. Can be used on celery, dill, parsnips, and parsley.
	Preemergence				
ɔrn, pop	atrazine	2-3 lb.	(See sweet corn)	(See sweet corn)	See sweet corn, *except the section on preemergence combinations.*
	Bladex	(See remarks)	Annuals	Preemergence only	Some pop corn varieties are sensitive to the application rate. (See remarks on Bladex under sweet corn.)
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	See sweet corn.
	Lasso	2-2.5 lb.	Annuals	Preemergence	See sweet corn.
	Princep	2-3 lb.	Annuals	Preemergence	Plant only crops so specified on the label the following year. Do not graze treated areas.
	Sutan+	3-4 lb.	Primarily annual grasses	Preplant soil application, incorporate with soil	See sweet corn.
	Postemergence				
	2,4-D	0.5 lb.	Broadleaved weeds	Postemergence	Apply when corn is 3 to 10 inches tall.
	Perennial grass control, applications outside the growing season (See separate listing at the end of this table.)				
	Preemergence				
ɔrn, sweet	atrazine	2-3 lb.	Annuals, annual and perennial grasses[5]	Preemergence, apply no later than 3 weeks after seeding. Shallow cultivation may improve weed control during dry weather.	Grow corn a second year without atrazine treatment. This chemical has a high soil residue. Do not plant other vegetable crops on a sprayed area until a second year of corn has been grown. Use atrazine where quackgrass is a problem. Residue hazard decreased when banded or in combination with Lasso, propachlor, or Sutan.
	Bladex	(See remarks)	Annuals	Preemergence only	Some sweet corn varieties are sensitive to the application rate. Has been shown to have less soil residue than atrazine. See label for rates and precautions. Do not use postemergence, or on sandy or loamy-sandy soils (under 1 percent organic matter). Can be combined with other herbicides to reduce the rate being used. NOTE: The Shell Chemical Co. has a bulletin on using Bladex on pop and sweet corn.
	Eradicane	4-6 lb.	Difficult-to-control weeds	Preplant soil application, incorporate with soil	Use to control weeds that are difficult to control with other herbicides, such as wild cane, nutsedge, quackgrass, wild Proso millet, and seedling Johnsongrass.
	Lasso	2-2.5 lb.	Annuals	Preemergence	Preplant incorporation may aid control of nutgrass.
	propachlor	4-5 lb.	Annuals	Preemergence	Do *not* use on sandy soils. Is an excellent herbicide on soils with a high organic-matter content.
	Sutan+	3-4 lb.	Primarily annual grasses	Preplant soil application, incorporate with soil	Especially useful on sandy soil and where nutgrass is a problem.
	Combinations				
	atrazine plus Lasso	1.5 lb. +2 lb.	Annuals and perennial grasses	Preemergence or preplant incorporated	See label for slightly higher rate of Lasso for preplant incorporation.
	atrazine plus propachlor	1.5 lb. +3 lb.	Annuals and perennial grasses	Preemergence	Use to reduce atrazine residue.
	atrazine plus Sutan+	1 lb. +3-4 lb.	Annuals and perennial grasses	Preplant soil incorporation, incorporate with soil immediately	Use where nutgrass is a problem and to reduce atrazine residue.
	Postemergence				
	2,4-D (amine)	0.5 lb.	Broadleaved weeds	Postemergence	Preferably, apply before corn is 6 inches tall. If corn is over 12 inches, reduce the rate to ¼ pound.
	atrazine	2 lb.	Annuals, annual and perennial grasses[5]	Directed spray 3 weeks after emergence	Can be combined with crop oils for postemergence application as an emergency measure. This may increase residue the following year. Preemergence use preferred. Do not graze or feed treated foliage for 21 days after treatment.
	Basagran	0.75-1 lb.	Broadleaved annual weeds, Canada thistle, and nutsedge	Early postemergence when the weeds are small and actively growing. Delay will result in less control.	For Canada thistle and nutsedge, split applications are preferred. Make the first one when the plants are 6 to 8 inches tall; for nutsedge, 7 to 10 days later; for Canada thistle, 10 to 14 days later (or use one application plus cultivation). Do not mix with other pesticides.
	Perennial grass control, applications outside the growing season (See separate listing at the end of this table.)				
	Stale seedbed before crop emergence (See separate listing at the end of this table.)				

ee notes at the end of the table.)

For Application During the Growing Season (continued)

Crop	*Treatment*	*Active ingredient per acre actually covered*[1]	*Weeds controlled*	*Timing of application (based on crop stage)*	*Remarks, cautions, limitations*
Cucumbers Muskmelons Watermelons	Alanap[6]	3-5 lb.	Annuals[3]	Immediately after seeding or transplanting	Do not use on cold soil. Rainfall or irrigation after tre ment gives maximum control.
		3-3.5 lb.		After transplanting or vining	Use the granular form. Keep away from foliage. Ap to soil after the weeds have been removed.
	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Is primarily a grasskiller. Consult label for sensiti crops within 18 months after application. Prefar can used in rotation with tomatoes, broccoli, cauliflow lettuce, carrots, onions, and summer squash within months. Soybeans can be planted 12 months after Pref application.
	Prefar plus Alanap[6]	4 lb. +2-3 lb.	Grasses and broadleaved weeds	Preplant soil incorporation for Prefar; Alanap, as an immediate postseeding application	Has value for broad-spectrum weed control. Consult lal for sensitive crops within 18 months after Prefar applic tion. Has EPA approval as a tank mixture.
	Where earliness is desired, black polyethylene mulch can be used as an alternative to herbicides. It will control annual weeds, conser moisture, and increase the soil temperature in early spring.				
	For melons — stale seedbed before crop emergence (See separate listing at the end of this table.)				
Eggplant	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	After plants are established, 4-6 weeks after transplanting	Cultivate and weed prior to application. Can be appli to plants as part of a uniform soil application.
	Devrinol	1-2 lb.	Annuals	Preplant soil incorporation	For use in transplanted eggplant.
	Where earliness is desired, black polyethylene mulch can be used as an alternative to herbicides. It will control annual weeds, conser moisture, and increase the soil temperature in early spring.				
Greens	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding	For use on collards, kale, mustard greens, and turnips.
	Treflan	0.5-0.75 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	For use on collards, kale, mustard greens, and turn greens.
	Furloe	1-2 lb.	Primarily broadleaved annuals	Preemergence	For spinach only. Use lower rates in cool, wet weather.
Horseradish	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after transplanting	Use for annual grass control and combine with TOK an early postemergence treatment for broadleaved weed
Lettuce	Balan	1.5 lb.	Annuals	Preplant soil incorporation Incorporate with soil immediately	Is primarily a grasskiller. Seed after application to weeks later. Do not plant wheat, barley, rye, grass, onion oats, beets, or spinach for 12 months after application.
	Kerb*	1-2 lb.	Annuals	Preemergence or preplant-incorporated	Do not use when the air temperature exceeds 85° F. U the lower rates listed on sandy soil. Do not use on peat muck soils. See label for rotation crops. For best result rainfall or irrigation is needed 1 to 2 days after applic tion, especially during warm weather.
	Stale seedbed before crop emergence (See separate listing at the end of this table.)				
	Preemergence				
Onions	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after seeding or transplanting	May not kill smartweed or common ragweed. Can be use on seeds, sets, or seedlings. Use only on mineral soil. Use lower rates on sandy soils. A double application o Dacthal can be used at seeding, layby, or both.
	Randox	4-6 lb.	Annuals[7] (primarily grasses)	Just before onions emerge	Use on muck soils. Heavy rainfall may reduce stan Very effective on purslane and pigweed.
	Postemergence				
	Furloe	3-6 lb.	Broadleaved weeds (especially smartweed)	On seeded onions: loop stage or after 3- to 4-leaf stage	In the later sprays, direct at base of onion plant. If mor than one application is applied do not exceed 6 pounds pe acre for the season. *Use lower rates in cool, wet weather* Use no later than 30 days before harvest. Do not use on sandy soils.
	Preemergence				
Peas	propachlor	4-4.9 lb.	Annuals	Preemergence	Do *not* use on sandy soil.
	Treflan	0.5-0.75 lb.	Annuals[2]	Preplant soil incorporation, incorporate with soil immediately	Seed after application to 3 weeks later. Some reductio of growth and stand reduction possible under stress. Ma suppress some root rot.
	Tolban	0.5-0.75 lb.	Annuals	Preplant soil application, incorporate with soil immediately	See remarks on Treflan. Has a state of Illinois label.
	Cobex	0.3-0.5 lb.	Annuals	Preplant soil incorporation	

Peas continued on the next page.

(See notes at the end of the table.)

For Application During the Growing Season (continued)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
	Preemergence or Postemergence				
Peas (continued)	Premerge-3	0.3-9 lb.	Annuals (primarily broad-leaved weeds)	Preemergence or postemergence	Preemergence use 6 to 9 pounds; postemergence, use 0.3 pound to 1.1 pounds. Apply prior to bloom when peas are 2 to 8 inches tall. See label for further precautions. Preemergence use may help suppress root rot.
	Postemergence				
	Basagran	0.75-1 lb.	Annual broad-leaved weeds, Canada thistle, nutsedge	When weeds are small and are actively growing; after peas have 3 pairs of leaves (or 4 nodes)	Can help control Canada thistle. Can provide good, broad-spectrum control when used with a grass-active herbicide. Do not mix with other pesticides. See Basagran entry under corn, postemergence for Canada thistle and nutgrass control.
	MCPB	1 lb.	Broadleaved weeds and Canada thistle	When peas are 3-7 inches tall and no later than 4 nodes prior to pea blossom	May delay maturity 1 to 4 days. Use at least 20 gallons of water per acre. Do not feed vines to livestock.
	MCPA	0.25-0.5 lb.			MCPA is more effective on mustard. MCPB is less injurious to peas.
	Perennial grass control, applications outside the growing season (See separate listing at the end of this table.)				
Potatoes, Irish	Eptam	3-6 lb.	Annual grasses and nutgrass[3]	Drag-off treatment at emergence or preplant soil application Incorporate with soil immediately	Use lower rate on sandy soil.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Drag-off treatment at emergence	Use a light incorporation.
	Lorox	0.75-2 lb.	Annuals	Apply prior to potato emergence	Plant tubers at least 2 inches deep. Do not replant treated area to other crops for 4 months after treatment. May injure crop on light, sandy soil. Do not apply over exposed tubers.
	dalapon	7 lb.	Quackgrass	Before plowing in spring; wait 4 days before plowing and planting	Not for fields intended for red-skinned varieties or White Rose. Do not plant potatoes for 4 weeks. Use surfactant as directed on label.
	metribuzin	0.25-0.5 lb.	Annuals (primarily broadleaved)	Postemergence, following a preemergence grass herbicide	Can be used preemergence also. Do not exceed 1 pound per acre in a season. Do not apply within 60 days of harvest. Do not use on red-skinned or early maturing white varieties. Do not apply in cool, wet weather.
	Lasso	2.5-3 lb.	Annuals	Apply at drag-off	Do not use on sandy soils. Can be used alone or in combination with Lorox or dinoseb.
	Stale seedbed before crop emergence (See separate listing at the end of this table.)				
Potatoes, sweet	Dacthal	6-10 lb.	Annuals[4] (primarily grasses)	Immediately after planting	
	Amiben	3 lb.	Annuals	Immediately after planting	
	Dymid, Enide	4-6 lb.	Annuals	Immediately after transplanting	Do not plant nonapproved crops on treated soil during the same season.
Squash Pumpkins	Amiben	3-4 lb.	Annuals	As soon after seeding as possible, or preplant-incorporated	Use on loam soils. Amiben can be applied broadcast or banded over the row in pumpkins.
	Prefar	4-6 lb.	Annuals (primarily grasses)	Preplant soil application, incorporate with soil immediately	Use on sandy soils. Is primarily a grasskiller. Consult label for sensitive crops within 18 months after application. Prefar can be used in rotation only with tomatoes, broccoli, cauliflower, lettuce, carrots, onions, and summer squash within 18 months of application. Soybeans can be planted 12 months after application of Prefar.
Tomatoes, direct-seeded and trans-planted	Dymid, Enide	4-6 lb.	Annuals	Preemergence	Do not plant other food crops on treated areas for 6 months. If used under dry soil conditions, a shallow (1 inch) incorporation as a preplant treatment may improve weed control. Can also be used on transplanted peppers.
	Devrinol	1-2 lb.	Annuals	Preplant soil incorporated	Also used on direct-seeded and transplanted peppers.
	metribuzin	0.25-1 lb. (min.-max.)	Primarily broad-leaf. Should be used with a grass-active herbicide.	Preplant incorporated. Post-emergence, can be broadcast or directed.	Apply with ground equipment to seeded and transplanted tomatoes. Do not use air-blast or other high-pressure spray equipment. Do not use on peppers.
		0.25-0.5 lb.		Preplant incorporated, transplant tomatoes	Alone or in a tank-mix combination with Treflan.
		0.25-0.5 lb.		Broadcast spray, established tomatoes	Single or multiple applications. Minimum of 14 days between treatments. Direct-seeded plants should have 5 or 6 leaves; transplants should show new growth.

Tomatoes continued on the next page.

(See notes at the end of the table.)

For Application During the Growing Season (continued)

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
Tomatoes (continued)	metribuzin (continued)	0.5-1 lb.		Directed spray, established tomatoes	Recommended for use in fields with severe weed prc lems, or for fields with hard-to-control weeds.
		(For min.-max. rates)			Do not apply within 7 days of harvest. Do not apj within 3 days following periods of cool, wet, or clou weather; otherwise, crop injury may occur. Do not apj to established tomatoes within 24 hours after the apr cation of other pesticides. Do not tank-mix with otł pesticides, except Treflan. Do not apply more than. pound per acre per crop season, or more than 1 pou per acre within a 35-day period. Allow at least 14 da between applications, regardless of the dosage or meth used. Do not use hot caps on tomatoes within 7 da before application, or at any time afterward.
	Stale seedbed before crop emergence (See separate listing at the end of this table.)				
Tomatoes and Peppers, transplanted	Amiben	3-4 lb.	Annuals	Wait 3 days after transplanting to apply	Use granular formulation only. Apply to dry foliage order to avoid leaf burn. Do not use on sandy soils.
	Treflan	0.5-1 lb.	Annuals[2] (primarily grasses)	Preplant soil application, incorporate with soil immediately	Some reduction of growth may be possible under grow stress conditions, or if rates are higher than suggest for the soil type.
	Where earliness is desired, black polyethylene mulch can be used as an alternative to herbicides. It will control annual weeds, conser moisture, and increase the soil temperature in early spring.				

For Application Outside the Growing Season

Crop	Treatment	Active ingredient per acre actually covered[1]	Weeds controlled	Timing of application (based on crop stage)	Remarks, cautions, limitations
	Stale seedbed, before crop emergence				
Asparagus	Paraquat*	0.5-1 lb.	All emerged green foliage	Before crop emergence; allow maximum weed emergence prior to treatment	Weeds that emerge after treatment will not be controlle Crop plants that have emerged at application will be iı jured. Do not apply within 18 months of harvest. U: with a preemergence or preplant sustained-action wee control system.
Corn, sweet Lettuce Melons Peppers Potatoes Tomatoes	Paraquat*	0.5-1 lb.	All emerged green foliage	Before crop emergence	Weeds that emerge after treatment will not be controlle Crop plants that have emerged at application will be iı jured. Use with a preemergence or preplant, sustainec action weed control system.
	Perennial weed control, applications during and outside the growing season				
Asparagus	Roundup	2-5 lb.	(See remarks)	Before emergence, or with shielded or directed sprays during fern growth	Use to control milkweed, thistle, field bindweed, quack grass, or Johnsongrass. Apply to quackgrass when it i 6-8 in. tall in the fall or spring. Apply to Johnsongras when it is at least 12 in. tall and actively growing. Do nc till for the specified time for each species (see label) Does not provide residual weed control. Do not mix store, or apply Roundup spray solutions in containers o spray tanks made of galvanized or unlined steel (excep stainless steel).
	Perennial grass control, applications outside the growing season				
Beans, edible Corn, sweet Corn, pop Peas	Roundup	2-3 lb.	(See remarks)	(See remarks)	Use for quackgrass or Johnsongrass control. Apply t quackgrass when 6 to 8 inches tall in fall or spring. Appl to Johnsongrass when at least 12 inches tall and activel growing. Do not till until 3 to 7 days after application Does not provide residual weed control. Do not mix store, or apply Roundup spray solutions in galvanizec steel or unlined steel containers (except stainless steel) oı spray tanks.

* Restricted-use herbicides are identified with an asterisk(*).

[1] Based on active ingredients (actual amount of active herbicide in material or acid equivalent). Use lower rate on sandy soil and higher rate on clay and loam soils. When using a band application over the row, adjust amount of material applied to the part of an acre treated. [2] May not control ragweed and panicum. [3] May not control smartweed. [4] May not control ragweed, smartweed, and velvetleaf. [5] May not control crabgrass. [6] Do *not* use Alanap Plus, Solo, Whistle, or Amoco Soybean herbicide. These materials all contain Alanap plus another ingredient that may cause injury. [7] May not control smartweed and velvetleaf.

NOTE: In the suggestions in this publication, trade names of herbicides are usually used. The list below shows trade names and their corresponding common names. **Restricted-use herbicides are identified with an asterisk(*).**

Common name	Trade name
alachlor	Lasso
atrazine	AAtrex and Atrazine
benefin	Balan
bensulide	Prefar
bentazon	Basagran
butylate+safener	Sutan+
CDAA	Randox
chloramben	Amiben
chlorpropham	Furloe
cyanazine	Bladex
cycloate	Ro-Neet
dalapon	Basfapon, Dowpon
DCPA	Dacthal
dinitramine	Cobex
dinoseb	Premerge-3, Sinox
diphenamid	Dymid, Enide
diuron	Karmex and others
EPTC	Eptam
EPTC+safener	Eradicane
glyphosate	Roundup
linuron	Lorox
MCPA, MCPB	(numerous)
metribuzin	Lexone, Sencor
napropamide	Devrinol
naptalam	Alanap
paraquat*	Paraquat*
profluralin	Tolban
pronamide*	Kerb*
propachlor	Bexton, Ramrod, and Propachlor
pyrazon	Pyramin
simazine	Princep
terbacil	Sinbar
trifluralin	Treflan
Petroleum solvent	Stoddard Solvent
2,4-D (amine)	(numerous)

Storing Pesticides and Containers

Keep pesticides and containers in a separate building, room, or enclosure used only for this purpose. Such buildings or rooms should be dry, ventilated, and locked. Fence outside storage areas to protect children and animals and to discourage pilferage. CAUTION: Do not store weedkillers, herbicides, or defoliants in the same room with insecticides. Chlorate salts can create a fire or explosion hazard. Remove only the pesticides needed for one day's operation and return empty containers — and any unused pesticide — to the storage area each day.

Disposing of Pesticides and Containers

Surplus Pesticides. To dispose of surplus pesticide mixtures, try to find other areas with the same pest problem and use up any extra tank mix or rinse water on these areas. Do not drain surplus pesticides in any location where they can contaminate wells, streams, rivers, lakes, or ponds.

Operators of landfills meeting environmental safety standards can obtain supplemental permits to handle toxic waste materials, including pesticides. To dispose of large quantities of surplus pesticides, contact the Illinois EPA Division of Land Pollution Control to locate the nearest landfill with a supplemental permit for toxic waste or to obtain specific instructions about disposal.

Pesticide containers. All empty pesticide containers, regardless of their type, should be rinsed three times before disposal. Rinse water should be dumped in the tank. Triple-rinsed cointainers should be punctured or broken to facilitate drainage and to prevent reuse for any purpose. They should then be hauled to a sanitary landfill for disposal. Small quantities of containers may be buried singly in open fields, with due regard for the protection of surface and subsurface water.

Illinois regulations permit the burning of combustible containers provided that they are burned on the premises where they were used, that they are burned more than 1,000 feet from residential areas, that the burning will not cause undue visibility or environmental hazards, and that no reasonable alternate disposal method is available.

Do not breathe smoke from burning pesticide containers, and do not burn containers that have weedkillers such as 2,4-D or similar herbicides. When these change to a gas, the vapors may damage nearby crops and shrubbery. Pesticides containing chlorates may explode when heated and, therefore, should not be burned.

Other Publications on Weed Control

Copies of the following publications on weed control are available from the office of your county Extension adviser in agriculture and the Office of Agricultural Publications, 123 Mumford Hall, 1301 West Gregory Drive, Urbana, Illinois 61801.

Calibrating and Adjusting Granular Row Applicators — Circular 1008
Controlling Weeds in the Home Garden — Circular 1051
Equipment and Calibration: Low Pressure Sprayers — Circular 1192
Turfgrass Pest Control — Circular 1076
Herbicides for Commercial Fruit Crops in Illinois — H-659
Herbicide Recommendations for Commercial Nurserymen — NC-2-80
1982 Row Crop Weed Control Guide
Weed Control in Small Grains, Forages, and Pastures

1982 HERBICIDE AND WEED CONTROL CHANGES FOR VEGETABLES - ILLINOIS[1]

Herbert J. Hopen

I. Nitrofen (TOK) has been lost (at least temporarily) for use on Illinois vegetable crops. TOK has been used in the past very effectively for broadleaf weed control in Brassica crops (broccoli, Brussels sprouts, cabbage and cauliflower), as well as carrots, horseradish and onions.

   a. In carrots there are adequate alternatives for weed control with the use of Treflan as a preplant incorporated material for grass control. In addition, Lorox can be used postemergence.

   b. There remains a severe problem for control of broadleaf weeds in the Brassica, horseradish and onion crops which will be grown in Illinois in 1982. For the Brassica crops there is the choice of using Treflan in both direct seeded and transplanted crops.

II. DCPA (Dacthal) supplies will be extremely limited in 1982 because of a disruption in manufacture of the material. Weed control choices for horseradish, onions, eggplants and greens will be reduced.

   a. In previous years, Dacthal plus TOK were the main herbicides for grass and broadleaf weed control in both horseradish and onions. Unless there are carry-over stocks of these two materials which growers have on hand (and which can legally be used by them if they have them available) there will be no herbicides available for use on horseradish in 1982.

   b. The herbicide choices for onions will also include any carry-over stocks of Dacthal or TOK. CDAA (Randox) and chloropropham (Furloe) can be used for control. Randox is grass active and Furloe is active on some broadleaf weeds, especially smartweed.

   c. The loss of the Dacthal supply has left us with only the recently added Devrinol (napropamide) for weed control in eggplant in 1982.

   d. Dacthal has also been lost for use in greens production and here the alternatives will be the use of Treflan and Furloe.

III. In asparagus, terbacil (Sinbar) has been cleared for use in established beds and metribuzin (Sencor or Lexone) can be used after harvest season. Metribuzin is a very effective broadleaf control material and should be a valuable aid in controlling broadleaves going into the fern production part of the growing season.

IV. Paraquat (Paraquat) was previously labeled for stale seed bed type of treatment in asparagus (that is, before crop emergence). New labels for use of Paraquat as a stale seed bed treatment have been issued for sweet corn, lettuce, melons, peppers, tomatoes and potatoes.

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[1] See "Weed Management Guide for Commercial Vegetable Growers" (Circular 907) for more details.

V. Prefar (bensulide) should be a more adaptive herbicide for use in vine crops as the period of waiting to plant another crop has been reduced for soybeans. Soybeans can now be planted within 12 months after Prefar application. Prefar is also now cleared for use on pumpkins. Consult the Prefar label for other waiting periods and crops that can be grown within the previously restricted 18 month period.

VI. Profluralin (Tolban) has a State of Illinois label for use in green pea production.

VII. With the loss of some of our herbicide choices we will need to rely more on mechanical and cultural types of control.

a. Weeds should be shaved off with a sharp hoe while gently breaking up the crust. Deep tillage causes severe injury to many shallow-rooted plants and helps place a fresh supply of weed seeds in position to germinate. Keeping equipment sharp and in good condition will help reduce injury to desirable plants. Hoe carefully around your plants and hand pull weeds close to the plants.

b. For warm season crops, black polyethylene mulch will *control annual weeds*, conserve soil moisture and increase early spring soil temperatures.

VIII. Research on new materials continued through 1981.

a. We have conducted research for several years with propachlor (Bexton and Ramrod) in onions and pumpkin and the decision if propachlor can be used in these crops must be made by the Environmental Protection Agency (EPA).

b. Metribuzin (Sencor or Lexone) seems to have promise for carrot weed control based on our research. The decision again is up to EPA for metribuzin in carrots.

c. During the 1981 growing season we evaluated oxyfluorfen (Goal) in cabbage, horseradish and onions. This work will continue to evaluate Goal as a possible replacement for TOK.

Herbert J. Hopen is Professor of Horticulture.

Fertilizer Guide 1982-83
for Commercial Vegetable Growers

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN • COLLEGE OF AGRICULTURE • COOPERATIVE EXTENSION SERVICE
CIRCULAR 1185

Commercial vegetable producers depend on chemical fertilizers to supply the nutrients required by their crops. Although many Illinois soils are naturally high in fertility, it is doubtful whether intensive cropping of vegetables could be achieved without adding fertilizer. In fact, many growers have fertilized excessively, resulting in large residual amounts of phosphorus, potassium, calcium, and magnesium in the soil. Although this residual fertility may not be detrimental, applying unneeded fertilizer raises costs without increasing production, thus reducing profits.

As production costs climb, growers find that they are operating with reduced profit margins. Only efficient producers can survive in today's economy. By testing your soil and applying only as much fertilizer as is needed you can save a significant amount of money. Using fertilizer efficiently provides greater profit and minimizes the release of potential pollutants into the environment.

Testing Your Soil

To determine how much of each nutrient must be added for optimum crop production, collect soil samples every 2 or 3 years and have them analyzed for pH and for phosphorus and potassium concentrations. The test results and your knowledge of the field's cropping and fertilization history will provide the information you need to develop a fertilization plan for the crop to be grown.

Samples should be collected in the late fall when the soil is relatively dry but not yet frozen. Separate samples should be tested for every field that differs in color, slope, drainage, or previous fertilization and cropping. Each sample should represent no more than 4 acres and should consist of several subsamples collected at random locations throughout the field. Check with your soil testing laboratory for more specific instructions.

Determining Fertilizer Application Rates

The soil test results will be reported in terms of the amount of elemental phosphorus (P) and elemental potassium (K) per acre. Referring to Table 1, determine which of the four soil fertility groups (A through D) your soil's phosphorus test level fits into. Then do the same for the potassium test level. These groups can then be used in conjunction with Table 2 to determine how much of the two nutrients you should add for the crop you plan to grow.

Locate the crop in Table 2, and then find the column under the phosphorus heading that corresponds to your soil's fertility group for phosphorus. The numbers in the column below the fertility group will tell you how many pounds of P_2O_5 you need to apply per acre to increase the phosphorus content to a satisfactory level. Follow the same procedure using the numbers in the potassium column to determine how much K_2O you should apply. If soil test results are not available, use the amounts of phosphorus and potassium recommended for fertility group B.

Since soil tests for nitrogen are of little value, the nitrogen recommendations in Table 2 are based on the needs of the various crops, but in developing a fertilization program you should also take into account the field's cropping history and the type of soil.

If the crop grown in the field during the previous year was a legume (soybeans or alfalfa), the amount of nitrogen applied can be 25 to 30 pounds per acre less than that recommended in Table 2. The nitrogen status of most vegetable crops can be determined by the color of the foliage. A pale green or slightly yellow color may indicate a need to apply additional nitrogen.

Unless otherwise indicated, the fertilizer recommendations given in this circular are for the mineral soils that predominate in Illinois. Vegetable crops grown on sandy soils usually require greater amounts of nitrogen and potassium. Splitting the nitrogen fertilizer between two separate applications will result in greater efficiency and production on sandy soils that are irrigated or that receive heavy rainfall.

Plantings made early in the season in cool, wet soils may respond well to the application of band-placed phosphorus or a starter solution in addition to the nutrients recommended in Table 2.

Table 1. Soil Fertility Groups for Phosphorus and Potassium

Nutrient	Fertility group A	B	C	D
	pounds per acre			
Bray P_1 phosphorus (P)	0-25	26-50	51-75	Above 75
Potassium (K)	0-100	101-250	251-350	Above 350

When more than one crop is to be grown in a field it is necessary to adjust the fertilizer application rates so that the nutrients needed by all of the crops are supplied. Tailoring a fertilizer program for such situations is difficult because the amount of a nutrient that is considered adequate for one crop may be undesirably low for another. For assistance, consult *Horticulture Facts* No. VC-7-80, "Fertilizer Guide for Market Gardeners." Other publications in this series that may be of interest to you are No. VC-17-81, "Micronutrient Applications for Vegetable Crops"; No. VC-8-80, "Conversion Tables for Fertilizer Calculations"; and No. VC-18-81, "Liming Vegetable Crops." You can obtain these publications from your county Cooperative Extension Service adviser or from the Department of Horticulture, 124 Mumford Hall, 1301 West Gregory Drive, University of Illinois, Urbana, Illinois 61801.

TABLE 2. FERTILIZER RECOMMENDATIONS FOR VEGETABLE CROPS

	Recommended application rate based on soil tests									
		Phosphorus (P_2O_5)				Potassium (K_2O)				
		Fertility group				Fertility group				
Crop	Nitrogen (N)	A	B	C	D	A	B	C	D	Suggested application method
ASPARAGUS		*pounds per acre*								
New plantings	50	150	50	25	0	150	50	25	0	Broadcast and plow down
	0	50	50	25	25	0	0	0	0	Apply in trench before setting
	30	0	0	0	0	50	50	25	25	Side-dress at first cultivation
Total	80	200	100	50	25	200	100	50	25	
Cutting beds										
Nonhybrids	50	150	100	50	25	200	150	100	50	Broadcast and disk
Hybrids	75	200	150	100	50	300	225	150	75	Broadcast and disk
In sandy soils an additional 50 pounds of nitrogen per acre can be applied as a sidedress after cutting. In new beds build up organic matter with cover crops and manure 1 or 2 years before planting crowns.										
BEANS										
Lima	20	150	100	50	0	150	100	50	0	Broadcast and plow down
	40	40	40	20	20	40	40	20	20	Band 2 in. × 2 in. at seeding
Total	60	190	140	70	20	190	140	70	20	
Snap	0	150	100	50	0	100	50	25	0	Broadcast and plow down
	40	40	40	20	20	40	40	20	20	Band 2 in. × 2 in. at seeding
Total	40	190	140	70	20	140	90	45	20	
Snap, second crop	30	20	20	20	20	40	40	20	20	Band 2 in. × 2 in. at seeding
In sandy soils an additional 25 pounds of nitrogen per acre can be applied as a sidedress when two or three true leaves have appeared. If the soil pH is greater than 6.8, apply 2 pounds of zinc and 1 pound of manganese per acre at planting.										
BEETS	75	150	100	50	25	200	150	100	50	Broadcast and disk
	50	0	0	0	0	0	0	0	0	Side-dress 4 to 6 weeks after planting
Total	125	150	100	50	25	200	150	100	50	
Apply 3 pounds of boron per acre on clay loams and 1 pound per acre on sandy soils.										
BROCCOLI AND CAULIFLOWER	100	200	150	75	50	200	150	75	50	Broadcast and disk
	50	0	0	0	0	0	0	0	0	Side-dress 2 to 3 weeks after transplanting
	50	0	0	0	0	0	0	0	0	Side-dress 5 to 6 weeks after transplanting if required
Total	200	200	150	75	50	200	150	75	50	
Apply 2 pounds of boron per acre on clay loams and 1 pound per acre on sandy soils if the pH is greater than 6.7. Early plantings in cold soil may respond well to a high-phosphorus starter solution.										
CABBAGE, COLLARDS, AND KALE	75	150	100	50	25	150	100	50	25	Broadcast and disk
	50	0	0	0	0	0	0	0	0	Side-dress 4 weeks after planting
Total	125	150	100	50	25	150	100	50	25	
Early plantings in cold soil may respond well to a high-phosphorus starter solution.										
CARROTS	50	150	100	50	25	200	150	100	50	Broadcast and disk
	30	0	0	0	0	0	0	0	0	Side-dress 4 weeks after seeding
Total	80	150	100	50	25	200	150	100	50	
In sandy soils an additional 30 pounds of nitrogen per acre may be applied as a sidedress between 7 and 8 weeks after seeding.										

TABLE 2. FERTILIZER RECOMMENDATIONS FOR VEGETABLE CROPS (continued)

Crop		Recommended application rate based on soil tests									Suggested application method
			Phosphorus (P_2O_5)				Potassium (K_2O)				
			Fertility group				Fertility group				
	Nitrogen (N)	A	B	C	D	A	B	C	D		
			pounds per acre								
CELERY		100	250	200	150	100	300	200	100	50	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress 4 weeks after planting
		25	0	0	0	0	0	0	0	0	Side-dress 8 weeks after planting
	Total	150	250	200	150	100	300	200	100	50	
Because celery has a high moisture requirement, irrigation is essential for commercial production. Use of a starter solution is recommended when transplanting celery.											
CUCUMBERS		50	100	50	0	0	150	100	50	0	Broadcast and plow down
		25	50	50	50	25	50	50	50	50	Band 2 in. × 2 in. at seeding
		25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
	Total	100	150	100	50	25	200	150	100	50	
EGGPLANT		75	200	150	100	50	250	150	100	50	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress 4 weeks after planting
		25	0	0	0	0	0	0	0	0	Side-dress 8 weeks after planting
	Total	125	200	150	100	50	250	150	100	50	
Use of a starter solution is recommended when transplanting eggplant.											
HORSERADISH		150	250	200	100	50	250	200	100	50	Broadcast and disk
LETTUCE (LEAF), ENDIVE, AND ESCAROLE		80	200	100	50	25	200	100	50	25	Broadcast and disk
		40	0	0	0	0	0	0	0	0	Side-dress 3 to 5 weeks after planting
	Total	120	200	100	50	25	200	100	50	25	
Apply only 75 pounds of nitrogen per acre to head lettuce because excessive nitrogen may result in loose heads.											
MUSKMELON		50	150	100	50	0	150	100	50	0	Broadcast and plow down
		25	50	50	50	50	50	50	50	50	Band 2 in. × 2 in. at seeding
		25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
	Total	100	200	150	100	50	200	150	100	50	
The use of black plastic mulch reduces leaching and may therefore make nitrogen sidedressings unnecessary on mineral soils.											
ONIONS		75	200	100	50	25	200	100	50	25	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress 4 to 5 weeks after planting
	Total	100	200	100	50	25	200	100	50	25	
For green onions an additional 25 pounds of nitrogen per acre can be applied as a sidedress from 4 to 5 weeks before harvest.											
PARSLEY		75	200	150	100	50	200	150	100	50	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress at each cutting
	Total	100	200	150	100	50	200	150	100	50	
PEAS		0	100	50	25	0	100	75	50	25	Broadcast and disk
		50	50	50	50	50	50	25	25	25	Band 2 in. × 2 in. at seeding
	Total	50	150	100	75	50	150	100	75	50	
After periods of heavy rains in the spring an additional 30 pounds of nitrogen per acre can be applied when peas are 4 to 6 inches tall. Apply only when the plants are dry to avoid burning the foliage.											
PEPPERS		100	200	150	100	50	250	150	100	50	Broadcast and disk
		50	0	0	0	0	0	0	0	0	Side-dress after first fruit set
	Total	150	200	150	100	50	250	150	100	50	
In sandy soils an additional 25 pounds of nitrogen may be applied as a sidedress after the first harvest. The use of a starter solution is recommended when transplanting peppers.											
POTATOES		0	150	100	0	0	200	150	100	50	Broadcast and disk
		100	100	100	100	100	100	100	100	50	Band-place at planting
		50	0	0	0	0	0	0	0	0	Side-dress at emergence
	Total	150	250	200	100	100	300	250	200	100	
In sandy soils an additional 30 pounds of nitrogen can be applied as a sidedress before the plants are about 8 or 10 inches tall. On soils with magnesium test values less than 250 pounds per acre, apply 50 pounds magnesium (MgO) per acre at planting.											

TABLE 2. FERTILIZER RECOMMENDATIONS FOR VEGETABLE CROPS (continued)

Crop		Recommended application rate based on soil tests									Suggested application method
			Phosphorus (P_2O_5)				Potassium (K_2O)				
			Fertility group				Fertility group				
		Nitrogen (N)	A	B	C	D	A	B	C	D	
		pounds per acre									
PUMPKINS		75	150	100	50	25	250	200	150	100	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
	Total	100	150	100	50	25	250	200	150	100	
Excessive use of nitrogen may result in thin walls and a flat side on jack-o'-lanterns.											
RHUBARB											
New plantings		50	250	200	150	100	250	200	150	50	Broadcast and plow down
		50	0	0	0	0	0	0	0	0	Side-dress around each hill 2 weeks after growth starts
	Total	100	250	200	150	100	250	200	150	50	
Cutting beds		50	200	150	100	50	250	150	100	50	Side-dress each hill in early spring
		50	50	50	50	50	50	50	50	50	Side-dress at last harvest
	Total	100	250	200	150	100	300	200	150	100	
SPINACH		100	200	150	100	50	200	150	100	50	Broadcast and disk
		20	0	0	0	0	0	0	0	0	Side-dress 4 to 5 weeks after planting
	Total	120	200	150	100	50	200	150	100	50	
SQUASH		75	150	100	50	25	200	100	50	25	Broadcast and disk
		25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
	Total	100	150	100	50	25	200	100	50	25	
SWEET CORN		100	150	100	75	50	150	100	75	50	Broadcast and disk
		30	0	0	0	0	0	0	0	0	Side-dress when corn is 12 in. tall
	Total	130	150	100	75	50	150	100	75	50	
TOMATOES — Fresh Market											
On sandy soils		150	250	200	100	50	200	150	75	50	Broadcast and plow down
		25	0	0	0	0	50	50	25	0	Side-dress at first cultivation
		25	0	0	0	0	50	0	0	0	Side-dress after first fruit set
	Total	200	250	200	100	50	300	200	100	50	
On loams		100	250	200	100	50	300	200	100	50	Broadcast and plow down
		25	0	0	0	0	0	0	0	0	Side-dress at first cultivation
		25	0	0	0	0	0	0	0	0	Side-dress after first fruit set
	Total	150	250	200	100	50	300	200	100	50	
The second sidedress may not be required on early or semideterminate tomatoes. The use of a starter solution is recommended when transplanting tomatoes.											
WATERMELONS		50	150	100	50	0	150	100	50	0	Broadcast and plow down
		25	50	50	50	50	50	50	50	50	Band 2 in. × 2 in. at seeding
		25	0	0	0	0	0	0	0	0	Side-dress when vines start to run
	Total	100	200	150	100	50	200	150	100	50	
The use of black plastic mulch reduces leaching and may therefore make nitrogen sidedressings unnecessary on mineral soils.											

This circular was prepared by John M. Gerber, Extension Specialist in Vegetable Crops, and John M. Swiader, Assistant Professor of Horticulture, University of Illinois at Urbana-Champaign.

Horticulture Facts

Testing for and Deactivating Herbicide Residues

VC-15-
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under FL & T

H. J. Hopen
Department of Horticulture

Residues of triazine herbicides (such as atrazine and simazine) or of substituted-urea herbicides (such as linuron and diuron) may persist in the soil for long periods. Cyanazine (Bladex) has been shown to have a shorter residual period than atrazine and, therefore, should be considered when planning rotations of corn and vegetables.

Attempts have been made to correlate residue persistence with rainfall, temperature, soil characteristics, cultivation practices, method and time of herbicide application, and rate of application. Thus far, however, predicting the extent of residue damage to sensitive crops the year following residual herbicide applications has been only partially successful.

TESTING FOR HERBICIDE RESIDUES

Chemical analyses for herbicide residues are slow and quite complicated. Such tests can be done in only a few specialized laboratories and usually are expensive.

Biological assays are more feasible, since they can be done with simple equipment found in most homes or offices. Although the biological assay outlined here does not provide an exact measure of the amount of residue present in the soil, the assay will indicate whether enough residue is present to harm sensitive crops. The bioassay for atrazine (using oats as a test species) was published in the December, 1967, issue of *Crops and Soils*. That method can also be adapted for use when testing for other residues.

1. Secure a representative soil sample from the field suspected of having atrazine residue. Take samples from several locations in the field, as when collecting soil samples to determine fertilizer requirements. Atrazine residue may appear in patches of a field. Enough areas must be sampled to avoid missing ones with a high residue content. Headlands and knolls frequently show the most residue injury. Take separate samples from areas where excessive residues may occur. Always take the soil sample the full depth of the plow slice, wheth or not the field is plowed. Remember t the assay is only as reliable or repres tative as the samples you take. Each s to be assayed requires about 10 pounds soil.

2. Assays should be run on the samples wit a week or two after they are obtained f the field. If the samples cannot be ass immediately, store the soil in a cold p if possible, allow it to freeze. When ples are stored indoors under warm condi tions, the atrazine residue may be lost.

3. If the soil is wet, spread it out and al low it to dry so it can be worked readil If the soil is cloddy, crush the clods i the size of pea or of a wheat seed, but not pulverize the soil.

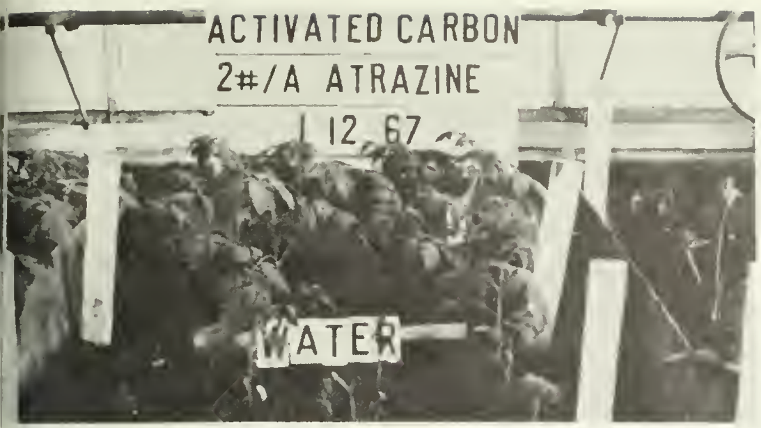
4. Adding about 50 percent by volume of coa sand will improve the physical condition silt and clay soils. If sand is added, mix it with the soil thoroughly.

5. Add about ½ gram of activated carbon to (5 pounds) of the soil or mixture of soi and sand. Mix the carbon with the soil thoroughly. The carbon deactivates the atrazine or other residue. For purposes comparison, soil treated this way provid the equivalent of soil without residue.

6. Partially fill two containers with soil that does *not* contain carbon and two othe with the soil-carbon mixture. These shou be containers holding about a pint to a quart. Punch holes in the bottom of the containers to allow drainage. Tin cans, paper milk cartons, or ice cream cartons are satisfactory for this purpose.

7. Plant about 15 oat seeds (or seeds of sus ceptible vegetable species of specific in terest) in each container and cover the seeds with about half an inch of soil. We the soil with water. Do not saturate the soil.

8. Place the containers in a warm place (abo 70° to 75° F.), where they will get the m sunlight possible. Sunlight usually is



ure 1. (BACK) Tomato seedlings growing in azine-treated soil but protected by a nsplant suspension with activated charcoal. ONT) Tomato seedlings in the same soil, but y water was used at transplanting. Note better survival and more normal-looking nts where charcoal was used.

ure 2. A field plot of tomatoes in which two rows on the left have atrazine residue. two on the right do not. The row of tomaes furthest at the left was protected by harcoal transplant suspension. The second from the left was only watered-in. Obusly, the survival rate was greater when rcoal was used in the soil containing atrae residue.

essential for the development of atrazine-injury symptoms. Artificial light has much less intensity than sunlight and, therefore, may not be satisfactory for symptom development.

. Injury symptoms on seedlings should become apparent about 3 weeks after planting. If the temperatures are below 70°F., more time is required. Water the plants sparingly. Do not allow the soil to dry out.

. Severe triazine injury is characterized by drooping leaves and by leaf-kill that extends from the tip of the leaf toward the base. Leaf-kill indicates the presence of a significant amount of residue in the soil. A marginal content of residue will stunt the growth of the oats without killing the leaves. Stunting can be determined by comparing the growth of oats in soil with carbon. Oats grown in soil with carbon should be normal and should show no atrazine injury or stunting, unless extremely high residues of atrazine are present in the soil sample.

11. If the oats show any evidence of leaf-killing or stunting, plant the field from which the samples were obtained with an atrazine-tolerant crop.

USING ACTIVATED CHARCOAL

Activated charcoal (or carbon) can reduce herbicide contamination in specific areas (gardens, greenhouses, lawns, and the like) and can also be used as a root dip to protect transplants (tomatoes, peppers, strawberries, ornamentals, and so on) in relation to triazine or substituted-urea herbicides. Activated carbon can also be used to "clean up" pesticide spills.

Other herbicides that may be deactivated by carbon include trifluralin (Treflan), bromacil (Hyvar-X), benefin (Balan), bensulide (Betasan, Pre-San, and Prefar), DCPA (Dacthal), dichlobenil (Casoron), diphenamid (Dymid, Enide), EPTC (Eptam), 2,4-D, and terbacil (Sinbar).

Activated carbon, now used in a wide range of applications in diverse industries, is manufactured by heating or chemically treating organic matter to achieve a porous structure. Doing this produces a large surface area within a relatively small volume. Most activated carbons are purified by acid and water washes to remove undesirable impurities and are available in both granular and powdered form. The charcoal used with outdoor grills and the like cannot be ground up to achieve the same pore structure characteristic of activated charcoal on a pound-for-pound basis.

The usefulness of activated carbon is based primarily on its ability to absorb molecules into its vast pore structure. The phenomenon of adsorption can take place either in gaseous or liquid phase systems. The adsorption is often selective when applied to systems containing more than one component. Two examples of this are using activated carbon in gas masks to remove poisonous vapors and as an antidote for accidentally ingested poisons.

WHERE TO OBTAIN ACTIVATED CHARCOAL

Some garden supply centers carry packaged activated carbon specifically designed for the uses outlined here. Several brands of a similar type of carbon are available.

Activated carbon is used extensively in dry-cleaning and water-purification units. Usually, the names of local distributors can be found in the Yellow Pages under "Cleaners and Driers Supplies," or by contacting a dry-cleaning establishment. In emergency cases, carbon probably could be purchased directly from a local dry cleaner. However, some dry-cleaning carbons may contain additives that will make them unsuitable.

Such local businesses are an especially valuable source of carbon in rural areas, where delivery from a distributor may be slow. Activated carbon is offered in containers of 1 to 50 pounds. Small quantities of purified activated carbon are available at pharmacies and at chemical supply houses.

APPLICATION METHODS

Two methods often are used to protect transplanted, susceptible species.

1. Mix activated carbon with water to make a slurry or paste (2 pounds in a gallon of water). Dip the transplant roots into the paste, making sure not to get the material on the foliage. With this method, 300 small transplants usually can be treated. Set out the treated plants while the roots are still wet.

2. Mix 1 pound of activated carbon in several gallons of water. Use this as a transplant "solution" (pour it around the roots) for about 300 plants. Because the activated carbon must be kept in suspension by stirring, the root-dip method is usually the more practical one.

The second procedure should not be used where phytotoxic herbicides (ones harmful to the plant you want to grow) were applied for weed control the year in which a susceptible crop was planted, but only as an emergency measure to overcome a residue from phytotoxic herbicides.

The second method can be used on transplanted crops, but enough charcoal cannot be placed on many crops seeded directly to absorb the herbicide in a large enough soil volume for satisfactory root development. For the direct-seeding of susceptible species, using a band deactivation of the soil may be necessary.

Mixing activated carbon into soil contaminated with undesirable herbicide residues may significantly reduce the uptake of the residues by the crops. If an area is contaminated with a common herbicide residue and a susceptible crop is to be seeded, apply activated carbon at 200 pounds per acre (1/2 pound per 100 square feet) for each pound per acre of the actual residue. (For differences between herbicides, see G.F. Warren, 1973, "Use of Activated Carbon to Inactivate Herbicide Residues," *North Central Weed Control Conference* 28:68-69.) The carbon should be uniformly incorporated to a depth of 3 or 4 inches. The efficiency of deactivation will depend on the organic-matter content and physical condition of the soil, the activity of the herbicide, and the sensitivity of the crop.

Horticulture Facts

Publications About Vegetable Crop Production

VC-12-80
(Rev. 2/81)

J.M. Gerber, H.J. Hopen, and J.W. Courter
Department of Horticulture

The following list is of publications pertinent to vegetable crop production that can be obtained from the University of Illinois. They will be of interest primarily to commercial vegetable growers, although home gardeners will also find some of them useful.

UNIVERSITY OF ILLINOIS CIRCULARS AND BULLETINS

Single copies of many of the following publications are available free from county Extension Offices, or from the Office of Agricultural Publications, 123 Mumford Hall, Urbana, IL 61801. Please note the single-copy charge for some items. Quantity discounts are available on C-718 and C-1150.

No.	Title
C-718	Weeds of the North Central states ($1.50)
C-808	Prevent 2,4-D injury to crops and ornamental plants
C-827	Controlling Johnsongrass in Illinois
C-828	Controlling giant foxtail in Illinois
C-850	Controlling poison ivy
C-879	Home greenhouses for year-round gardening pleasure
C-884	Growing vegetable transplants
C-897	Insecticide recommendations for vegetable crops
C-907	Herbicide guide for commercial vegetable growers
C-981	Growing tomatoes at home
C-990	Legal aspects of crop spraying
C-1184	Fungicide guide for commercial vegetable growers
C-1008	Calibrating and adjusting granular row applicators
C-1038	Calibrating and maintaining spray equipment
C-1084	Illinois horseradish: a natural condiment
C-1138	Pesticides and honey bees
C-1139	Agricultural labor laws in Illinois
C-1150	Vegetable gardening for Illinois ($2)
C-1156	Soil productivity in Illinois
C-1174	Vegetable varieties for commercial market growers
B-725	Soils of Illinois
B-735	Soil type acreages in Illinois ($1)
B-749	Seeding rates, cultivars, and planting methods for small processing onions

HORTICULTURE FACTS (VEGETABLE SERIES)

Single copies are available free of charge from 101 Vegetable Crops Building, University of Illinois, Urbana, IL 61801. However, there is a charge for quantity orders. For price quotations, contact the Department of Horticulture, 124 Mumford Hall, Urbana, IL 61801.

No.	Title
VC-1-80R	Commercial vegetable varieties for plant growers
VC-2-81R	Garden values for vegetables and small fruits
VC-3-79	Storing home-grown onions
VC-4-79	Inhibiting sprouts in onions in potatoes that are to be stored
VC-5-80	Organic gardening and soil fertility
VC-6-80	Making compost for the garden
VC-7-80	Fertilizer guide for market gardeners
VC-8-80	Fertilizer conversion tables
VC-9-80	Fertilizing your vegetable garden
VC-10-80	Sources of vegetable seeds
VC-11-80	Harvesting vegetables
VC-13-80	Growing sprouts indoors

HORTICULTURE FACTS (HORTICULTURE MARKETING SERIES)

No.	Title
HM-1-79	Pick-your-own marketing of fruits and vegetables
HM-2-79	Liability and insurance for U-pick operations
HM-3-79	Net weights and processed yields of fruits and vegetables in common retail units
HM-4-80	Establishing a community farmers' market

USDA PUBLICATIONS

Single copies of the following publications from the U.S. Department of Agriculture are available free of charge from 101 Vegetable Crops Building, Urbana, IL 61801. Send requests for larger quantities to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

No.	Title
AB-212	Mint farming
AB-380	Insects and diseases of vegetables in the home garden
AFS-8-9-1	Starting plants from seeds
AFS-8-13-1	Vegetable harvest and storage
AH-203	Tomato diseases and their control
AH-221	Lettuce production in the U.S.
AH-382	Commercial production of greenhouse tomatoes
AH-388	Sweet potato culture and diseases
AH-474	Potato diseases
AH-507	Usual planting and harvesting dates for fresh market and processing vegetables
F-1537	Johnsongrass ... as a weed
F-2148	Aphids on leafy vegetables
F-2183	Using phenoxy herbicides effectively
F-2200	Controlling tomato diseases
F-2201	Growing ginseng
F-2232	Commercial growing of asparagus
F-2233	Commercial growing of watercress
F-2239	Growing cauliflower and broccoli
G-180	Growing tomatoes in the home garden
G-202	Growing vegetables in the home garden
L-360	Growing table beets
L-445	Electric heating of hotbeds
L-509	Muskmelon for the garden
L-523	Canada thistle and its control
L-544	Protecting honey bees from pesticides
L-547	Commercial growing of horseradish
L-548	Controlling the Mexican bean beetle
L-555	Rhubarb production
MRR-637	Hydrocooling vegetables

PLANT PATHOLOGY REPORTS

The following publications are available at 10 cents each from the Department of Plant Pathology, N-533 Turner Hall, Urbana, IL 61801.

No.	Title
201	Stewart's leaf blight of corn
203	Common corn smut
900	Controlling diseases in the home vegetable garden
903	Carrot yellows
915	Vegetable seed treatment
916	Damping-off and seedling blights of vegetables
920	Anthracnose of cucumber, muskmelon, and other vine crops
942	Gray-mold rot or Botrytis blight of vegetables
955	Blackleg of cabbage and other Crucifers

ENTOMOLOGY FACTSHEETS

The following factsheets are available from Extension Entomology, 165 Natural Resources Building, Urbana, IL 61801.

No.	Title
21	Armyworms
23	White grub
24	Common stalk borer
25	Grape Colaspis
26	Corn rootworm
27	Corn seed insects
28	Corn blotch leaf miner
29	Corn leaf aphid
30	Some common insect predators and parasites
31	Corn root aphid and corn field ant
32	Japanese beetle
33	Corn earworm
34	Fall armyworm
35	Chinch bug
36	Corn flea beetle
37	Billbugs
38	Black cutworm
39	Thrips on corn
40	Corn sap beetle
41	Miscellaneous corn leaf feeding insects
42	Webworm
43	Wireworm
44	Cabbage maggot on cabbage and related crops
45	Cabbage worm
46	Striped and spotted cucumber beetles
48	Onion thrips
49	Asparagus beetle
50	Onion maggot
51	Squash bugs on melon and vine crops
84	Slugs
90	Check list of insecticides
96	Measurements of small quantity of spray
97	Dilution table for insecticides
120	Corn insects—above ground
125	Common vegetable insects
130	Hornworms